

Sattleria: a European genus of brachypterous alpine moths (Lepidoptera: Gelechiidae)

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SYNOPSIS. The genus *Sattleria* Povolný (Gelechiinae, Gnorimoschemini), endemic to the alpine zone of European mountains, is revised. Eight species, including four newly described, are recognized as valid; one species is recalled from synonymy, one taxon reverts from subspecific to specific status, one subspecies is transferred to a different species and one synonym is newly established. Separate keys for males and females are provided, based on characters of the genitalia. Male and female moths and their genitalia are described and illustrated.

INTRODUCTION

In many parts of Europe the alpine zone was the last natural ecosystem almost undisturbed by man's activities and, as long as the mountains were remote and inaccessible, their unique flora and fauna could be considered relatively safe from destruction by mass tourism, intensive agriculture or industrial processes. Increasing recreational use of the mountains by a large, ever more affluent population, encouraged by commercial interests eager to exploit Europe's last touristic frontier, is now causing widespread overdevelopment and simultaneous destruction or fragmentation of sensitive natural habitats. Thus, numerous areas previously inaccessible to a wider public have been opened up to tourism through the construction of new roads, hotels, holiday chalets, ski lifts and pistes, cable cars and other facilities, and with the growing number of visitors such problems as

the disposal of refuse add to the pressure on the environment. At the same time the agricultural sector's drive for greater profitability contributes through excessive application of fertilizers to reduced biodiversity even on remote alpine pastures, whilst long-range industrial air pollution appears to be responsible for dramatic die-back of alpine forests with resultant soil erosion (see, for example, Blab *et al.*, 1987: 170–177; Diem, 1988: 2–8).

Amongst the insects likely to be threatened by such degradation of their habitats a number of Lepidoptera species are particularly vulnerable, because their females are flightless and they are often confined to small disjunct colonies. An increased trend towards flightlessness with a more or less pronounced reduction of the wings has long been known to occur in the females of Lepidoptera inhabiting the alpine zone of high mountains in many parts of the world. Such abortion of flight and reduction of the flight organs as an apparent response to the ecological conditions in an extreme

environment is not confined to high altitude species but is also observed in many Lepidoptera endemic to small remote oceanic islands and in species which are active as adults during the cold season; the whole phenomenon is extensively reviewed by Sattler (1991).

In the European Alps examples of Lepidoptera species with wing reduction in the female sex are found in at least seven different families (Huemer & Sattler, 1989: 257) but the total number of species, which is in excess of 20, is still uncertain because several unresolved species-complexes are involved. One such complex is the gelechiid genus *Sattleria* Povolný (Gelechiinae: Gnorimoschemini), which is endemic to Europe and inhabits the higher mountains from the Pyrenees in the west to the Carpathians in the east in a number of disjunct populations. It is likely that, together with their habitats, many of its taxa are endangered; however, to obtain meaningful data for assessing the impact of adverse factors on the alpine ecosystem and its constituent parts, it is imperative first to understand the taxonomy of the organisms involved. It is therefore a purpose of this paper to elucidate the hitherto unresolved taxonomy of the known *Sattleria* populations and summarize the limited available ecological data.

When he proposed the genus *Sattleria*, Povolný (1965: 490–492) was ambivalent about the systematic status of the included taxa. He regarded the genus as monotypic, with *S. dzieduszyckii* (Nowicki)

representing one variable species, but would not exclude the possibility that some of the more extreme morphologically separable forms might be distinct species. At the same time he dismissed *Gelechia pyrenaica* Petry as falling within the range of variation of *dzieduszyckii*, and subsequently synonymized it formally with the latter (Povolný, 1967: 175), although Petry had been emphatic that both were distinct. As Povolný's views had never been challenged it came as a surprise when, during a field trip by members of the BMNH Microlepidoptera Section (G. S. Robinson, K. Sattler & K. R. C. Tuck) in 1981, Petry's observations in the central Pyrenees were fully confirmed. On the slopes of Pic du Midi de Bigorre two *Sattleria* species, clearly separable in both sexes externally (Fig. 1) and by their genitalia, were found to fly together in the same biotope. In the light of these findings it was decided to reassess the taxonomic status of all *Sattleria* populations because it is not unreasonable to assume that, if two undisputed species occur side by side in the central Pyrenees, other morphologically separable forms elsewhere may also represent distinct species.

Preliminary results of our studies were presented at the Sixth Innsbrucker Lepidopterologengespräch, held on 20–21 October 1984 at the Tiroler Landesmuseum Ferdinandeum, where we produced evidence to support our view that *Sattleria* comprises a complex of several closely related but



Fig. 1 Males (left) and females (right) of two species of *Sattleria* from the Pyrenees: *S. arcuata* (top), *S. pyrenaica* (bottom).

morphologically distinguishable species. A second-hand report on our presentation prompted Povolný (1987) to pre-empt our planned publication by a hastily produced paper in which he reiterated his belief in *dzieduszyckii* as a single variable species. In essence he recognized several geographical forms, variously referred to as 'Rassenkomplex', 'Rassenkreis', 'Populationsgruppe' or subspecies, but emphasized that, for the time being, these are to be taken as representing merely statistical trends. At the same time he stated that it is impossible to assign individual moths of unknown geographic origin unambiguously to any of those subspecific groups. A key factor in his argument was the strong variation in size, coloration and genitalia structures he believed to have observed in his specimens from the Pyrenees; however, from his illustrated examples it is clear that he misinterpreted as intraspecific variation the differences between the widespread *S. pyrenaica* (Petty) and two geographically more restricted and hitherto undescribed species. Thus his colour figures, intended to demonstrate a remarkable range of variation in '*S. dzieduszyckii pyrenaica*', represent two males of *S. pyrenaica* (Petty) (figs 14, 15) from Pic du Midi and Mt Canigou respectively, flanked by *S. arcuata* sp. n. (fig. 13) from Pic du Midi and *S. angustispina* sp. n. (fig. 16) from Mt Canigou. It may have further misled Povolný that apparently he had transposed the genitalia of his specimens from Mt Canigou; the genitalia in text-fig. 12 belong to the moth in colour-fig. 16 and those in text-fig. 13 to the moth in colour-fig. 15, not the other way round as the accompanying label data would suggest.

Due to lack of material from several under-collected areas in the western Alps and mountains in Yugoslavia and Bulgaria there still remain some unresolved problems. Nevertheless, we believe to have shown in our study that *Sattleria* comprises several clear, morphologically distinguishable species.

MATERIAL AND METHODS

Our study of *Sattleria* is based on over 400 specimens (σ : ♀ ratio 6: 1), about 200 of which originated from various museums and private collections whilst a similar number was collected by us. All specimens recorded under 'Material examined' are in BMNH unless stated otherwise. The primary types of three of the seven previously described nominal taxa were examined, together with topotypical specimens of the other four, and

most of the material recorded in earlier publications, usually as *Gelechia dzieduszyckii* Nowicki, was re-assessed, including several of the specimens illustrated or otherwise itemized by Povolný (1965; 1967; 1983; 1987). We were unable to trace any examples from Bulgaria (Rebel, 1903: 329) whilst the only known specimens from Montenegro (Rebel, 1913: 330) and Albania (Rebel & Zerny, 1931: 146), which belong to NM, Vienna, have not yet been returned by Povolný and were not examined.

We studied 117 genitalia slides (84 males, 33 females), most of which were specifically prepared for this work. The male genitalia were 'unrolled' in accordance with the technique previously described (Pitkin, 1986). Originally developed for the gelechiid genus *Mirificarma* Gozmány, this method also proved ideal for *Sattleria* males; without sacrificing any critical character it allows the two-dimensional display of all taxonomically important structures – a prerequisite for successful photomicrography. The advantages of the unrolling technique for interpreting complex genitalia structures are immediately obvious when our illustrations are compared with those of Povolný (1987, figs 1–13), which are based on conventional preparations of the 'entire', strongly three-dimensional genital armature.

As a result of a literature survey over 70 references to nominal taxa of *Sattleria* were traced; however, most of them are faunistic records or entries in catalogues and check-lists of little information value. Only a limited number of papers contain worthwhile biological observations (e.g., Burmann, 1954; 1977) or discuss taxonomic aspects (e.g. Povolný, 1965; 1967; 1987) and are recorded in the systematic part of our work.

In the past, collecting of *Sattleria* was mostly sporadic and only one lepidopterist ever made a special study (Burmann, 1954) in the course of which he accumulated appreciable series of specimens. Many of the mountains where *Sattleria* populations occur were rarely visited by microlepidopterists and minimal material exists in collections; for example, only one male each is known from Korab (Albania) and Durmitor (Montenegro) and very few specimens, all males, were ever collected in the Julijske Alpe (Slovenija) and Abruzzo (central Italy). Even in the much better explored Alps collecting was previously extremely difficult in the higher regions. Many suitable habitats could only be reached after long strenuous hikes and, as they usually lacked overnight shelter, field work was limited to just a few daytime hours, often further curtailed by the notoriously unpredictable weather conditions. Thus, like many

other Microlepidoptera of the alpine zone, *Sattleria* specimens are comparatively rare in collections, particularly the brachypterous females, and Povolný's claim to have examined 'ample series' ('reichliche Serien') or 'extensive material' ('ausgedehntes Material') from 'all European mountain ranges, where [*Sattleria*] occurs' ('aus allen europäischen Gebirgen, wo sie vorkommt') (Povolný, 1965: 492; 1987: 85) is clearly exaggerated.

In recent times collecting and field studies have become very much easier, because more localities are now freely accessible by road or cable car and there are more facilities for spending the night in or near suitable habitats. We carried out field work in the central and eastern Pyrenees (K. S., 1981), southern Carpathians (L. M. P. & K. S., 1984) and Lechtaler Alpen (K. S., 1987) whilst unsuccessful searches for *Sattleria* were made in the eastern Alps (Raxalpe; K. S., 1985) and south-eastern Alps (Alpi Giulie/Julijske Alpe; Canin, Montasio, Mangrt; L. M. P. & K. S., 1987).

During the day, *Sattleria* males are occasionally flushed out of their hiding places, particularly in early morning and late afternoon, and can then be netted. Disturbed males fly only short distances, unless they are carried away by strong winds, and as they stay close to the ground they are sometimes difficult to see against the background of rocks and vegetation.

In suitable habitats with sparse vegetation and many flat stones a search of the ground can be most productive. Stones in the immediate vicinity of plant cushions can be turned over to expose specimens of both sexes, either sitting on the ground or on the underside of such stones.

As for other insects hidden in inaccessible substrates such as deep scree or dense vegetation, a beesmoker can be used successfully to drive *Sattleria* males and females out of hiding. This method is particularly effective on damp days when the smoke lingers on the ground. Smoke is usually produced from cartridges made of corrugated cardboard; however, locally available combustibles such as dry plant material or sheep dung can be substituted. During field work in the central Pyrenees on Pic du Midi de Bigorre a locally common lichen proved a most effective, long lasting fuel on damp days when it had the feel of good pipe tobacco, whilst on dry days it dried out quickly, becoming brittle and unsuitable. It is advantageous to impregnate one end of the cardboard cartridge with potassium nitrate for greater ease of lighting in windy weather. Care should be taken not to cause fires when emptying the beesmoker; in dry habitats it may be safer to restrict its use to damp days.

Both sexes of *Sattleria* respond to light (Burmman,

1954: 349; Klimesch, 1961: 650). The standard technique of running a mercury vapour light in front of a white sheet can therefore be employed but appears to produce only modest results, due to the limited motility of the moths. A night search between about midnight and 01.00 hrs with the aid of a Petromax paraffin lantern was found to be much more fruitful. A lantern placed on the ground during that time in a suitable habitat will attract the males in the near vicinity. The approaching moths can then be netted or collected directly into glass tubes, and every ten minutes or so the lantern is moved to a new location. In spite of a specific search no females were located with that method and few other Microlepidoptera were attracted at that time.

On occasions when a night search proved impractical or it was intended to sample different spots simultaneously, a Common trap was employed. This trap is equipped with a 6 watt actinic tube operated by a 12 volt car battery and charged with tetrachloroethane as a killing agent. It is specifically designed to collect the larger and small moths in separate compartments and thus prevent damage to the Microlepidoptera (Common, 1986). Only the males were caught in this trap, and inspections during its operation indicated that they were not usually attracted before midnight.

Rearing from the egg has not yet been tried and may be difficult if larvae overwinter twice as suggested by Burmann (1954: 350), but a search for larvae and pupae was found to be successful.

ABBREVIATIONS

BMNH	British Museum (Natural History), London, England.
BURM	Burmman collection, Innsbruck, Austria.
ETH	Eidgenössische Technische Hochschule, Zurich, Switzerland.
HUEM	Huemer collection, Innsbruck, Austria.
MCSN	Museo Civico di Storia Naturale, Milan, Italy.
MINGA	Muzeul de Istorie Naturala 'Grigore Antipa', Bucharest, Rumania.
MM	Moravske Museum, Brno, Czechoslovakia.
MNHN	Muséum National d'Histoire Naturelle, Paris, France.
NM	Naturhistorisches Museum, Vienna, Austria.
NMB	Naturhistorisches Museum, Basle, Switzerland.
TM	Természettudományi Muzéum, Budapest, Hungary.
WHIT	Whitebread collection, Magden, Switzerland.
ZI	Zoological Institute, Leningrad, U.S.S.R.

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THE SYSTEMATIC POSITION OF SATTLERIA

S. dzieduszyckii (Nowicki), the type-species of *Sattleria* Povolný, has had a chequered history with regard to its generic position. Originally described in '*Gelechia* (*Anacamptis* HS.)', where it was placed next to *Acompsia maculosella* (Herrich-Schäffer) (Gelechiidae: Dichomerinac), it was subsequently transferred to *Doryphora* Heinemann (= *Xystophora* Wocke) and within that genus associated with species which are now accommodated in *Monochroa* Heinemann (Gelechiidae: Aristoteliinae) (Wocke, 1871: 298). Rebel (1901: 145) placed *dzieduszyckii* in *Gelechia* (subgenus *Gelechia*) amongst a group of species which were later separated as *Teleiopsis* Sattler, a position in which it was also retained by Meyrick (1925: 77). Following a revision of the collective genus *Gelechia*, *dzieduszyckii* was removed to the *Gnorimoschemina* group (Gelechiinae: Gnorimoschemini) (Sattler, 1960: 69), where a separate genus, *Sattleria* Povolný, was eventually proposed for it.

Sattleria is established as monophyletic by several autapomorphies: in the male genitalia the presence of the usually forked posterior processes of the vinculum, and the anellus in the shape of a pair of perforated disks; in the female genitalia the presence of characteristic sternal pockets. A likely further autapomorphy is the reduction of the wings in the female sex.

Although it is universally accepted that *Sattleria* belongs to the Gelechiinae, tribe Gnorimoschemini, this has not yet been demonstrated beyond doubt. The main synapomorphy of the subfamily Gelechiinae is the division of the male abdominal segment 8 along the pleural line, which enables tergite and sternite to operate as independent covers for the genitalia. This arrangement separates the Gelechiinae from other subfamilies in which segment 8 forms a continuous ring into which the genitalia are usually withdrawn. In the *Sattleria* male the structure of segment 8 (Figs 48–50) clearly shows the gelechiine condition.

The Gelechiinae are currently divided into the tribes Gelechiini, Teleiodini and Gnorimoschemini. Whilst there appears to be agreement that most of the 40 genera united in the Gnorimoschemini form a monophyletic group, this has yet to be established and it is here suggested that the thorn-like signum bursae of the female is a synapomorphy of this tribe. Regrettably, in the *Sattleria* female the signum is secondarily lost and, until further synapomorphies are found, its gnorimoschemine status can only be deduced from overall similarities in conjunction with a specialized anellus character (see below) which *Sattleria* shares with a subgroup of undisputed Gnorimoschemini.

No classification of the Gnorimoschemini has ever been proposed, but an attempt was made by Povolný (1967) to express his views on the phylogenetic relationships of the genera within the tribe in a diagram, although it was not in the form of a cladogram. A recent idiosyncratic numerical analysis of phylogenetic relationships in Gnorimoschemini by Povolný & Sustek (1988) is less helpful because it does not provide clear results and merely demonstrates the unsuitability of the chosen technique for resolving such relationships. In Povolný's diagram of 1967 the Gnorimoschemini are divided into the gnorimoschemoid, scrobipalpoid and scrobipalpoid branches, the last of which is subdivided into the scrobipalpoid, ephyterid and caryocolid groups of genera. The placement of *Sattleria* in the scrobipalpoid group next to *Scrobipalopsis* Povolný and *Scrobipalpa* Janse was based primarily on similarities of the *Sattleria* fore wing pattern with that of *Scrobipalopsis petasitis* (Pfaffenzeller) (Povolný, 1965: 490, text-fig.; 1967: 174); however, the mere presence of the three typical stigmata in both genera is irrelevant for establishing phylogenetic relationships, because it is a groundplan character of at least the ditrysian Lepidoptera, and no synapomorphies were found to confirm Povolný's view.

In contrast to Povolný it is here believed with Huemer (1988: 445) that *Sattleria* is closely related

to the so-called caryocolid genera *Agonochaetia* Povolný, *Pogochaetia* Staudinger, *Tila* Povolný, *Lutilabria* Povolný, *Klimeschiopsis* Povolný, *Caryocolum* Gregor & Povolný and *Cosmardia* Povolný, which are characterized morphologically by a reduction of the gnathos hook and development of sclerotized anellus structures in the male genitalia and biologically by the exclusive utilization of Caryophyllaceae as host-plants of the larvae (host-plants of *Agonochaetia* and *Lutilabria* unknown).

A hooked gnathos is probably a groundplan character of the Gelechiidae and is widespread in the Gnorimoschemini; its reduction in the caryocolid genera is here considered a synapomorphy of that group, and the well developed gnathos hook of *Sattleria* is a plesiomorphic character. In *Agonochaetia* (Fig. 65), *Pogochaetia*, *Tila* and *Caryocolum* (Fig. 64) the anellus is equipped with a pair of needle-like or peg-like sclerotizations, a structure unknown in other Gelechiidae. In the first three genera they are striking needles of considerable size, sometimes exceeding the aedeagus in length (Povolný, 1965: figs 8, 10, 11; 1974: figs 1–3; Sattler, 1968: fig. 11), whilst in *Caryocolum*, if present, they are short, peg-like and may bear a terminal seta (Huemer, 1988: figs 102, 123). The anellus of *Sattleria*, a pair of sclerotized disks with perforated centres (Fig. 66), an autapomorphy of this genus, is here interpreted as an extreme reduction of such structure and thus a synapomorphy with caryocolid genera.

Our view that *Sattleria* is closely related to caryocolid Gnorimoschemini is also supported by the host-plants of the larvae. Although, based on observations by Burmann (1954), it was assumed that *Sattleria* larvae were Saxifragaceae feeders, there is now increasing evidence that they live primarily on Caryophyllaceae, a plant family rarely utilized by Gelechiidae other than the caryocolid Gnorimoschemini. As far as can be ascertained from published and unpublished sources only five other gelechiid species can be associated with Caryophyllaceae: *Eulamprotes wilkella* (L.) on *Cerastium*; *Bryotropha figulella* (Staudinger) and *B. tachyptilella* (Rebel) possibly feeding on *Silene*; *Teleiodes myricariella* (Frey) normally feeding on Tamaricaceae but once reared on *Silene* (Huemer, pers. comm.); and *Scrobipalpa salinella* (Zeller) on Chenopodiaceae but occasionally found feeding on *Spergularia*.

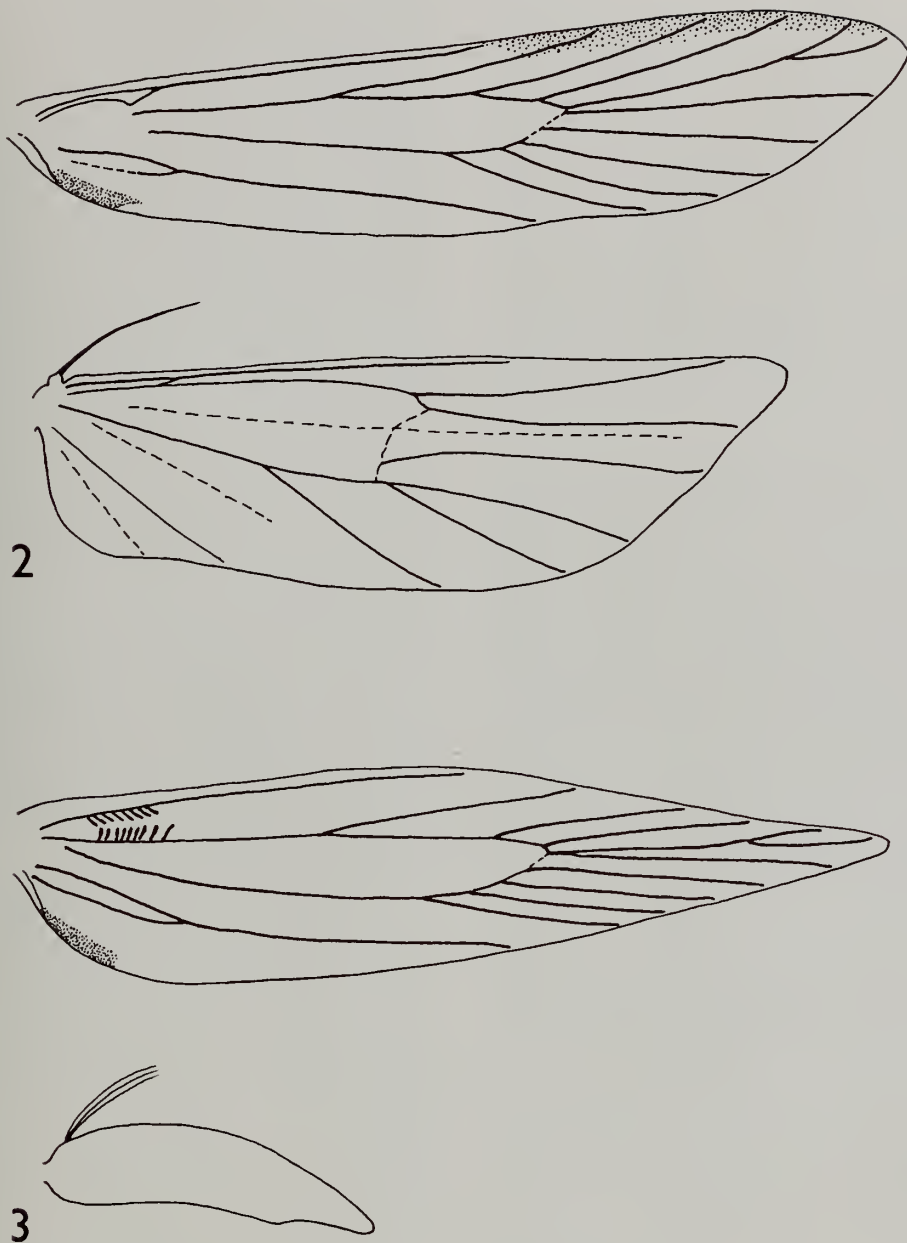
No study has been made to resolve the phylogeny within the caryocolid genera and it is not possible at this stage to identify the sister-group of *Sattleria*.

SATTLERIA Povolný

Sattleria Povolný, 1965: 490. Type-species: *Gelechia dzieduszzyckii* Nowicki, 1864, by original designation and monotypy.

♂. 6.5–11.5 mm. Frons evenly convex. Ocellus present but small. Proboscis well developed, longer than labial palpus, squamose at base. Maxillary palpus with four segments, folded over base of proboscis. Labial palpus recurved, segment 3 acute, about as long as 2. Antenna two-thirds to three-quarters length of fore wing, scape without pecten. Fore wing broadest in distal half, length about 4.5–5 times greatest width; costa straight to weakly concave, weak indication of tornus. Coloration various shades of grey, with diffuse light transverse line extended between distal fifth of costa and tornus, stigmata black: short plical dash sometimes extended to base, discal often small but distinct, discocellular sagittate; usually complete row of marginal spots from distal fifth of costa around apex and along termen to tornus. Costa of fore wing (Fig. 2) with variably developed weak pterostigma between Sc and R5. Discal cell about three-fifths to two-thirds length of wing, discocellular vein oblique, more or less parallel to termen; R1 from middle, R2–R4+5 free from cell, free ends of R4 and R5 one-quarter to one-third length of common stalk; M1 close to or connate with R4+5; distance at base M1–M2 usually greater than M2–M3; distance CuA1–CuA2 variable, half to twice distance M3–CuA1. Hind wing (Fig. 2) about four-fifths length of fore wing, broad, costa almost straight, termen more or less straight, very weakly concave beneath apex. Sc+R1 to distal third of costa, R1 distinct between Rs and Sc; Rs and M1 separate, distance at base M1–M2 about twice M2–M3; M3 and CuA1 connate or on short stalk; CuA2 from about distal third of cell. ♀. 5.0–8.5 mm. As ♂ but antenna little shorter than fore wing. Fore wing (Fig. 3) broadly lanceolate, costa distinctly convex, no tornus, fringe very short. Coloration and markings similar to those of ♂ but discocellular stigma rarely sagittate, marginal spots always absent. All veins present and tubular as in ♂ but much closer together. Hind wing (Fig. 3) narrow, lanceolate, only about one-third length of fore wing, veins strongly reduced, not tubular; frenulum triple.

GENITALIA ♂ (Figs 27, 48–50). Tergite and sternite 8 separate, tergite narrower than sternite, posteriorly rounded; sternite broad, posteriorly rounded or with V-shaped median emargination; coremata absent. Uncus narrower than tegumen, distally more or less rounded. Gnathos with large



Figs 2, 3 Wing venation of *Sattleria melaleucella*. 2, ♂. 3, ♀ (different scale).

spiculate culcitula and strong, sharply pointed hook. Anterior margin of tegumen with broad emargination, pedunculi long. Valva usually slender, digitate; saccus clearly separated, always shorter, shape variable. Posterior margin of vinculum with pair of characteristic, frequently forked, strongly sclerotized processes; saccus of moderate width, with more or less parallel margins. Anellus with pair of centrally perforated sclerotized disks. Aedeagus as long as or longer

than tegumen, slender, straight; coecum hardly inflated, base sometimes splayed; ventral surface sometimes with median projection; apical arm with sclerotized hook, usually at right angles to longitudinal axis of aedeagus; ductus ejaculatorius enters dorsally near base.

GENITALIA ♀ (Fig. 28). Papilla analis longer than wide, unspecialised; apophysis posterior about three-quarters to four-fifths length of abdomen;

telescopic membranous part of ovipositor apparently without dorsal invagination or sac. Segment 8 dorsally membranous, sclerotizations confined to ventral and ventrolateral surface. Sternite 8 with pair of characteristic pockets, sternal surface medially often with conspicuous irregular folds or longitudinal ridges. Apophysis anterior rod-like, about one-third length of apophysis posterior; sclerotized area at base extended into ostium bursae, sometimes fused with posterior end of antrum; narrow, strongly sclerotized band from base to sternal pockets. Long tubular sclerotized antrum, more or less length of apophysis anterior. Membranous ductus bursae usually shorter than antrum, corpus bursae spherical or oval, without signum.

Ductus seminalis arising dorsally from anterior end of sclerotized antrum, short, without pseudobursa or bulla seminalis. Vestibulum with papilla. Canalis spiralis short, about length of canalis receptaculi; vesicula of moderate size; spermatheca (receptaculum seminis) with small lagena, utriculus about three to four times length of lagena, glandula receptaculi very long, filiform. Accessory glands with short ductus sebaceus, its half nearest junction of sacci sebacei an inflated reservoir; pair of narrow tubular sacci sebacei terminating in long filiform glandulae sebaceae. Oviductus communis inferior merged with anal tube shortly before anal opening to form cloaca. [Description of ductus seminalis – cloaca based on an examination of a single female of *S. melaleucella*.]

REMARKS. There is considerable individual variation in some genital characters of *Sattleria*, notably the saccus and the base of the aedeagus in the male, and an unusually high level of deformity was observed in the relatively small number of females examined. For example, two females of *melaleucella* have a strongly reduced apophysis anterior whilst the genitalia of one female of *angustispina* are strongly asymmetrical (Fig. 55). A barely discernible featureless vestigial signum was found in two individuals of *pyrenaica*; its presence is an indication that the loss of this organ in *Sattleria* is secondary but it is too strongly reduced to draw inferences as to its original shape.

BIOLOGY. Our knowledge of the biology of *Sattleria* is still sketchy, the only significant published observations being those made by Burmann (1954) in the Austrian Lechtaler Alpen. *Sattleria* species are restricted to the alpine zone of the European mountains where they can be found between 1500 m and 3500 m, although they usually occur upwards of 2000 m. Typical habitats are open slopes with coarse scree and sparse vegetation, but several species have also been

observed in the dense grass of alpine pastures and amongst low growing *Rhododendron*. The freshly emerged moths, with their wings still undeveloped, have been observed in the early hours of the morning (Burmann, 1954: 348). Later in the day they usually hide deeper in scree, rock crevices or vegetation. In the early morning and at dusk, less frequently in the daytime, males are sometimes disturbed from their hiding places and fly short distances before settling again in a sheltered spot. They are relatively poor fliers but can run well and on rare occasions make short jumps. The brachypterous females are incapable of flying but can also run and, when disturbed, jump short distances of up to 50 mm.

According to our observations in the Pyrenees (*S. pyrenaica*, *S. arcuata*) and southern Carpathians (*S. dzieduszyckii*) the males have a period of particular activity between about midnight and 01.00 hrs. It seems logical to assume that this flight is in search of the females and that the latter should at the same time move from their hiding places to more exposed sites in order to await the males; however, no females were noticed by us during nocturnal searches. The courtship behaviour has never been observed, but a mating pair was found in the early afternoon under a stone, with the male half eaten by a spider. Burmann (1954: 349) suspected that a female he had seen walking from one plant to another in the afternoon was in the process of depositing her eggs.

The flight period of *Sattleria* can vary greatly from one year to the next and probably also between different localities, depending to a considerable extent on local conditions such as altitude, exposure to the elements, and the weather conditions in a given year. Adults examined by us were collected or bred between late June and mid-September; however, the main flight period appears to be mid-July to mid-August, unless these dates merely reflect the most popular time for entomological visits to the higher European mountains. Exceptionally, some reared adults did not emerge until late September – early October.

The ovum, which is probably laid singly or in small clusters on parts of the host-plant, has never been observed and the duration of the egg stage and the number of larval instars are unknown. It is also unknown whether the first instar larva mines, like the early instars of many other Gelechiidae including some *Caryocolum* species. Larvae have been found in July-August, living singly in a loosely spun silken tube that is often extended from the upper parts of the host-plant to the roots or nearby stones, where the larva seeks shelter when disturbed. The frass is deposited in a small heap outside the larval tube. Pupation takes place



Fig. 4 Distribution map of the species of *Sattleria*; 1, *S. arcuata*; 2, *S. pyrenaica*; 3, *S. angustispina*; 4, *S. breviramus*; 5, *S. melaleucella*; 6, *S. basistrigella basistrigella*; 7, *S. basistrigella triglavica*; 8, *S. syriaca*; 9, *S. dzieduszyckii*. Unconfirmed records are queried. Circles without numbers represent unidentified species. The dotted line represents the major mountain ranges of Europe.

in a dense cocoon that is spun under stones or amongst the host-plant and is often covered with grains of sand or particles of plant debris. As the larva may rest for some time in the cocoon before pupating, the length of the pupal stage is unknown, but it is unlikely to exceed two weeks.

It is not yet known how *Sattleria* overwinters. Based on his studies of *S. melaleucella* in the Lechtaler Alpen, Burmann (1954: 350; 1977: 146) assumed that overwintering takes place in the larval stage and that the presence of young and mature larvae together in July/August indicated that this might occur twice. Povolný (1987: 85, 86) claimed to have made similar observations on *S. dzieduszyckii* in the Czechoslovakian Tatry and in part supported Burmann's view but suggested that the larva might overwinter once or twice and even considered that the pupa might possibly lie over for the winter. The fact that freshly emerged adults can be found when the first plants are in bloom, soon after the snow has melted, indicates that at least some individuals overwinter in an advanced stage of development. Moreover, it could be argued that adults of *S. basistrigella*, which emerged in captivity as late as September/October, when their natural habitat at 2600 m may already have been snow-covered, would have remained as pupae in the wild. However, overwintering as a pupa is considered unlikely because all larvae reared to date have resulted in adults in the same season and there is as yet no evidence of a pupal diapause.

HOST-PLANTS

Caryophyllaceae: *Silene acaulis* (L.) Jacqu. – Switzerland, Zermatt (*Whitebread*) (*S. basistrigella*),

Cerastium latifolium L. – Austria, Rhätikon (*Huemer*) (*S. melaleucella*),

Cerastium uniflorum Clairv. – Austria, Lechtaler Alpen (*Huemer*) (*S. melaleucella*),

Moehringia sp. – Austria, Lechtaler Alpen (*Sattler*) (*S. melaleucella*) (a pupa found on this plant).

Saxifragaceae: *Saxifraga biflora* subsp. *macropetala* (Kern.) Rouay & Camus – Austria, Lechtaler Alpen (Burmann, 1954: 350; *Huemer, Sattler*) (*S. melaleucella*),

Saxifraga spp. – Czechoslovakia, Tatra mountains (Povolný, 1987: 88) (*S. dzieduszyckii*).

With one exception, the limited observations on the host-plants of *Sattleria* were made in the Alps and apply to only two species, *S. melaleucella* and *S. basistrigella*. The host-record for *S. dzieduszyckii* in the Tatra mountains, where Povolný (1987: 88) observed larvae on an unspecified *Saxifraga* species but failed to rear the moths,

requires confirmation because we collected adults of the same species in the southern Carpathians in a spot where *Saxifraga* was so rare that other host-plants, probably Caryophyllaceae, must have been involved. Although *Saxifraga* species are the only host-plants of *Sattleria* recorded in the literature (Burmann, 1954, 1977; Povolný, 1987) there is now increasing evidence that the larvae are primarily Caryophyllaceae-feeders. Even in the Lechtaler Alpen, where Burmann found the larvae exclusively on *Saxifraga biflora* subsp. *macropetala*, further host-plants could be demonstrated when during an excursion to Mutteköpf in mid-August 1987 (P. Huemer, K. & E. Sattler, I. Schatz) larvae were also discovered on *Cerastium uniflorum*, whilst a single pupa, from which a female later emerged, was found in a clump of *Moehringia*. Although *Sattleria* larvae clearly are oligophagous, i.e. they utilize more than one plant genus, in this instance even from two unrelated plant families, there is evidence that in some localities they may be specialized on just one plant genus or species. For example, Huemer (pers. comm.) observed the larvae of *S. melaleucella* in Rhätikon, Brandner Tal, exclusively on *Cerastium latifolium*, and a specific search on other plants, including species of *Saxifraga*, was unsuccessful. The suggestion that *Sattleria* larvae may be mining unspecified Compositae (Asteraceae) (Povolný, 1980: 204) is unsubstantiated and must be considered erroneous.

DISTRIBUTION (Fig. 4). Disjunct populations in higher European mountains. Pyrenees (Spain, Andorra, France), Alps (France, Switzerland, Germany, Austria, Italy, Yugoslavia), Appennino Abruzzese (Italy), Carpathians (Poland, Czechoslovakia, ? U.S.S.R.), Durmitor (Yugoslavia), Korab (Albania/Yugoslavia), Rila Planina (Bulgaria).

CHECKLIST OF THE SPECIES OF SATTLERIA

SATTLERIA Povolný, 1965

arcuata sp. n.

pyrenaica (Petty, 1904) stat. rev.

angustispina sp. n.

breviramus sp. n.

melaleucella (Constant, 1865) sp. rev.

fusca (Burmann, 1954) syn. n.

basistrigella basistrigella (Müller-Rutz, 1934) stat. n.

basistrigella triglavica Povolný, 1987, stat. n.

styriaca sp. n.

dzieduszyckii (Nowicki, 1864)

tatica (Gregor & Povolný, 1955)

Key to the species of *Sattleria*

Males

- 1 Sacculus broad at base, abruptly tapered towards apex (Figs 33, 40, 41, 44, 47) 2
 - Sacculus gradually tapered or base not broadened (Figs 29, 30, 32, 34–39, 43, 45, 46) 5
- 2 Secondary process of vinculum broad (Figs 40, 41, 44). Fore wing with distinct dark stripe along fold (Figs 12, 13, 15) 3
 - Secondary process of vinculum narrow, sometimes filiform, difficult to discern (Figs 33, 47). Fore wing without distinct dark stripe along fold 4
- 3 Tapered apex of sacculus short; secondary process of vinculum angular or evenly rounded (Figs 40, 41) ... *basistrigella*
 - Tapered apex of sacculus long, curved; secondary process of vinculum distinctly tapered (Fig. 44) *styriaca*
- 4 Primary process of vinculum about level with sacculus at apex; secondary process a distinct spine (Fig. 33) *angustispina*
 - Primary process of vinculum not reaching base of sacculus; secondary process hair-like (Fig. 47) *breviramus*
- 5 Secondary process of vinculum broadly rounded (Figs 43, 45, 46) 6
 - Secondary process of vinculum spine- or blade-like (Figs 29, 30, 32, 34–39) 7
- 6 Sacculus evenly tapered from base; secondary process of vinculum moderately broad, resembling a shark's fin (Figs 45, 46) *dzieduszyckii*
 - Sacculus broadest at about distal third; secondary process of vinculum very broad (Fig. 43) *basistrigella triglavica*
- 7 Aedeagus traversed towards middle by broad arch; apical arm long, distinctly curved (Fig. 29) ... *arcuata*
 - Aedeagus not traversed by broad arch; apical arm straight or slightly curved, usually small (Figs 30–32, 35, 38, 39) 8
- 8 Aedeagus with median projection (Figs 35, 38); if projection small, secondary process of vinculum a triangular spine (Fig. 39) *melaleucella*
 - Aedeagus without median projection; secondary process of vinculum a blade, apex often blunt (Figs 30–32) *pyrenaica*

Females

NOTE. The females of *breviramus* and *basistrigella triglavica* are unknown.

- 1 Pair of pockets in anterior half or middle of sternite 8 (Figs 51, 54, 56–59, 61) 2
 - Pair of pockets in posterior half of sternite 8 (posterior edge of pocket at least two-thirds from anterior margin of sternite) (Figs 52, 53, 60, 62) 6
- [If intermediate, treat as either state.]

- 2 Pockets at anterior end of sternite 8; inner edge of apophysis anterior approximately at right angle with sternite 8 (Fig. 54). *angustispina*
 - Pockets at least slightly distant from anterior margin of sternite 8; inner edge of apophysis anterior forming even curve with sternite 8 (Figs 51, 56–59, 61) 3
- 3 Sclerotized area at base of apophysis anterior extended distinctly beyond sternal pockets towards middle of sternite; sclerotized antrum widely separated from sclerotized parts of sternite 8 (Fig. 51) ... *arcuata*
 - Sclerotized area at base of apophysis anterior extended barely beyond sternal pockets; sclerotized antrum almost in contact with sclerotized parts of sternite 8 (Figs 56–59, 61) 4
- 4 Longitudinal ridges between pockets of sternite 8 distinct, approximated or partly fused (Fig. 59) *basistrigella basistrigella*
 - Longitudinal ridges widely separated or indistinct (Figs 56–58, 61) 5
- 5 Longitudinal ridges between pockets of sternite 8 distinct, widely separated (Figs 56–58) ... *melaleucella*
 - Longitudinal ridges indistinct (Fig. 61) *styriaca*
- 6 Sternite 8 with distinctly sclerotized medial ridges; antrum usually exceeding apophyses anteriores (Fig. 60) ... *basistrigella basistrigella* (southwestern form)
 - Sternite 8 medially membranous; antrum not exceeding apophyses anteriores, usually shorter (Figs 52, 53, 62) 7
- 7 Sclerotized area at base of apophysis anterior broad, rounded, sometimes invaginated (Figs 52, 53) *pyrenaica*
 - Base of apophysis anterior without broad, rounded sclerotized area (Fig. 62) *dzieduszyckii*

***Sattleria arcuata* sp. n.**

(Figs 1, 4, 5, 17, 29, 48, 51)

[*Gelechia dzieduszyckii* Nowicki; Petry, 1904: 3–4. Misidentification.]
 [*Sattleria dzieduszyckii pyrenaica* (Petry); Povolný, 1987: colour pl., fig. 13. Misidentification.]

♂, 7.7–11.0 mm. ♀, 5.5–6.8 mm. Labial palpus with dark apex. Fore wing (Figs 1, 5, 17) usually with large diffuse dark areas forming irregular indistinct transverse bands; without dark stripe along fold.

GENITALIA ♂ (Fig. 29). Sternite 8 usually rounded or barely emarginate posteriorly; rarely distinctly emarginate. Sacculus gradually swollen at base, not sharply broadened into lobe. Apex of primary process of vinculum almost level with apex of sacculus; sometimes with several setae scattered on outer surface; secondary process a narrow or broad-based spine, arising in basal quarter of

primary process; processes without serrated edges. Saccus usually parallel-sided, occasionally tapering slightly. Aedeagus without median projection; traversed towards middle by broad arch; apical arm a large hook. Base of aedeagus splayed, usually slightly.

GENITALIA ♀ (Fig. 51). Pair of narrow pockets in anterior half of sternite 8, at least slightly away from anterior margin. Pair of longitudinal ridges usually well separated. Pair of distinct sclerotized areas at base of apophyses anteriores projecting sharply beyond pockets of sternite 8. Inner edge of apophysis anterior forming even curve with sternite 8. Sclerotized antrum detached from base of, and extending beyond, apophyses anteriores; sclerotization at posterior end irregular, slightly convex or concave.

REMARKS. One of the largest species of *Sattleria*, *S. arcuata* is exceeded in size only by the largest specimens of *melaleucella*. It differs from the usually smaller *pyrenaica*, with which it occurs together, in the male by the posteriorly rounded rather than deeply emarginated sternite 8, the short, spine-like, smooth-edged secondary process of the vinculum, and the aedeagus with a strongly developed median arch and long, curved, apical arm. In the female genitalia *arcuata* is distinguished by the anterior rather than posterior position of the pockets in sternite 8, the sharply projecting sclerotized areas at the base of the apophyses anteriores, and the long detached sclerotized antrum.

BIOLOGY. Host-plant unknown. The adults occur in more or less heavily grazed alpine pasture and are found together with those of *S. pyrenaica*; however, whilst *arcuata* was only observed above 2100 m and was most frequent at about 2600–2700 m, *pyrenaica* was still common as low as 1600–1700 m. Flight period: July–August. Pic du Midi de Bigorre, the type-locality of *S. arcuata* and *S. pyrenaica*, was visited in 1981 by members of the BMNH Microlepidoptera Section. Although between 22 and 24 July it was still cold and there was much snow on the ground, the adults of *arcuata* were present in small numbers in snow-free spots, where some alpine plants were in flower. Following fresh heavy snowfall on 25 July the area was abandoned until 2 August, by which time most of the snow had melted and *arcuata* was found in quantity.

DISTRIBUTION (Fig. 4). Hautes-Pyrénées: Pic du Midi de Bigorre area (France).

MATERIAL EXAMINED (including 8 ♂, 3 ♀ genitalia preparations)

Holotype ♂, **France:** Hautes-Pyrénées, Pic du Midi de Bigorre, 2650 m, 2.viii.1981 (*Sattler, Tuck & Robinson*) (genitalia slide no. 24678).

Paratypes. **France:** 1 ♂, Pyrénées, 2600 m, 2.viii.1927 (NM); 73 ♂, 8 ♀, Hautes-Pyrénées, Pic du Midi de Bigorre, 2400 m, 2650 m, 22.vii–4.viii.1981 (*Sattler, Tuck & Robinson*); 1, Hautes-Pyrénées, Col du Tourmalet, 2150 m, 24.vii.1981 (*Sattler, Tuck & Robinson*); 1, Hautes-Pyrénées, Gèdre 13.viii.1896 (MNHN).

Sattleria pyrenaica (Petry) stat. rev.

(Figs 1, 4, 6, 18, 28, 30–32, 49, 52, 53, 63)

Gelechia pyrenaica Petry, 1904: 3. LECTOTYPE ♂, FRANCE (Museum der Natur, Gotha, East Germany), here designated [examined]. *Sattleria dzieduszyckii pyrenaica* (Petry); Povolný, 1987: fig. 13, colour pl., figs 14, 15.

♂, 6.5–8.6 mm. ♀, 3.7–5.5 mm. Fore wing (Figs 1, 6, 18) without dark stripe along fold; usually without large dark areas, or weakly patterned.

GENITALIA ♂ (Figs 30–32). Sternite 8 emarginate posteriorly. Saccus not broadened into lobe basally. Apex of primary process of vinculum almost level with apex of saccus; without setae or with up to three setae; ventral edge of process sometimes slightly serrated. Secondary process of vinculum a blade with slightly serrated or uneven edge, arising between basal third and middle of primary process. Saccus usually slightly tapered. Aedeagus without median projection; never traversed by broad arch although narrow arch towards middle of aedeagus sometimes visible. Apical arm of aedeagus straight or slightly curved, usually small. Base of aedeagus usually strongly splayed.

GENITALIA ♀ (Figs 28, 52, 53, 63). Pair of broad pockets towards posterior margin of sternite 8; posterior edge of pocket at least two-thirds from anterior margin of sternite. Pair of sclerotized areas at base of apophyses anteriores with broad, rounded structure; distance between outer edges of these always greater (usually 1.5 times) than distance between outer edges of pockets. Antrum meeting base of, and shorter than, apophyses anteriores; sclerotization at posterior end often concave.

REMARKS. *S. pyrenaica*, the smallest species of the genus, is externally rather similar to *dzieduszyckii* but is easily distinguished in the male genitalia by the narrow, curved, rather than broadly rounded secondary process of the vinculum and the distinctly splayed base of the aedeagus. In the female both species share the posterior position of the

pockets in sternite 8 but in *pyrenaica* the sclerotized areas at the base of the apophyses anteriores are broad and rounded, and sometimes invaginated. Differences between *pyrenaica* and the other two *Sattleria* species known from the Pyrenees are discussed under *arcuata* and *angustispina* respectively.

A male from Pic du Midi de Bigorre, where *pyrenaica* occurs together with *arcuata*, shows some intermediate characters and is here interpreted as a hybrid between these two species. The almost unicolorous moth strongly resembles *pyrenaica*, and the abdominal sternite 8 is deeply emarginate posteriorly as in typical males of that species. In the genitalia (Fig. 27) the secondary process of the vinculum arises between the basal quarter and one-third of the primary process, as in *pyrenaica*, but is intermediate in shape; it is triangular and lacks the serrated edge characteristic of *pyrenaica*. As in that species, the aedeagus lacks a distinct median arch, whilst the apical arm, which resembles that of *arcuata*, is longer than that of *pyrenaica* and is distinctly curved.

G. pyrenaica was described from 13 male syntypes from Pic du Midi de Bigorre, eight of which have been examined.

GEOGRAPHICAL VARIATION. Specimens from the central Pyrenees, Andorra (males only) and Mt Canigou are remarkably uniform externally and in their genitalia. Two males from the Basses Alpes are here provisionally considered as an eastern form of *pyrenaica* although they differ in several characters from the main form in the Pyrenees. In the eastern form (Fig. 32) the secondary process of the vinculum is directed posteriad rather than laterad and is longer and less evenly curved than in the main form. At the same time the apical arm of the aedeagus is longer and slightly curved, resembling more that of *arcuata*, whilst the base of the aedeagus is only slightly splayed.

BIOLOGY. Host-plant unknown. The adults usually occur on more or less heavily grazed alpine pastures above 1600–1700 m. In all visited localities (central Pyrenees, Andorra, Mont Canigou) the males were attracted, like those of other *Sattleria* species (*S. arcuata* sp. n., *S. dzieduszyckii* (Nowicki)), between about midnight and 01.00 hrs to a Petromax paraffin hand lantern (see p. 000). On Pic du Midi de Bigorre and Mont Canigou some males were observed flying at dawn and dusk above low-growing *Rhododendron* shrub; in the latter locality they were also attracted to a Common trap placed in a small grove of 3–5 m tall pine trees. Above 2100 m on Pic du Midi de Bigorre *S. pyrenaica* was often found together with *S. arcuata* sp. n. The females were found by a careful search of the ground, usually hidden under

stones, or were driven out of the vegetation with the aid of a beesmoker. Flight period: July–August.

DISTRIBUTION (Fig. 4). Pyrénées (France: Hautes-Pyrénées and Pyrénées Orientales; Andorra); Alps (France: Basses-Alpes).

MATERIAL EXAMINED

Main form (including 16 ♂, 5 ♀ genitalia preparations)

Lectotype ♂, **France:** [Haute-] Pyrénées, Pic du Midi de Bigorre, 2400–2700 m, 24.vii.1901 (*Petry*) (Museum der Natur, Gotha).

France: 7 ♂ (paralectotypes), Pic du Midi de Bigorre, 2400–2700 m, 23–26.vii.1901 (*Petry*) (Museum der Natur, Gotha); 38 ♂, 13 ♀, Pic du Midi de Bigorre, 2400 m, 2650 m, 22.vii–4.viii.1981; 5 ♂, 1 ♀, Hautes-Pyrénées, Barèges – Col du Tourmalet 1600–1700 m, 25.vii.1981; 24 ♂, Pyrénées Orientales, Mt Canigou, 2200 m, 30, 31.vii.1981; 1 ♂, 2 ♀, Mt Canigou, 17.vii, 9.viii.1894 (MINGA; MNHN, TM); 1 ♂, 1 ♀. [Pyrénées Orientales,] Lipaudère, 20.vii.1894 (MNHN). **Andorra:** 19 ♂, Coma del Forat, 2400 m, 28.vii.1981.

Eastern form (including 2 ♂ genitalia preparations)

France: 2 ♂, [Basses-Alpes,] Chambeyron, 11.viii.1897 (MNHN).

Sattleria angustispina sp. n.

(Figs 4, 7, 19, 33, 50, 54, 55)

[*Sattleria dzieduszyckii* (Nowicki); Povolný, 1967: fig. 14. Misidentification.]

[*Sattleria dzieduszyckii pyrenaica* (Petry); Povolný, 1987: figs 12, 17 (partim), 24 (labelled in error as 25 in legend), colour pl., fig. 16. Misidentification.]

♂, 8.1–9.0 mm. ♀, 5.3–6.2 mm. Labial palpus with dark apex. Fore wing (Figs 7, 19) without dark stripe along fold; usually with irregular dark transverse bands.

GENITALIA ♂ (Figs 33, 50). Sternite 8 rounded posteriorly. Basal half of sacculus sharply broadened into lobe. Primary process of vinculum long, approaching apex of sacculus; secondary process a long narrow spine, arising in basal fifth of primary process; processes without serrated edges. Saccus tapered. Aedeagus with small median projection; apical arm small and straight. Base of aedeagus not noticeably splayed.

GENITALIA ♀ (Figs 54, 55). Pair of narrow pockets at anterior margin of sternite 8. Inner edge of apophysis anterior approximately forming right angle with sternite 8. Antrum slightly shorter than, or same length as, apophyses anteriores;

sclerotization at posterior end irregular, slightly convex.

REMARKS. *S. angustispina* is larger and much more variegated than *pyrenaica*, with which it occurs together on Mt Canigou. The male genitalia differ from those of all other *Sattleria* species in the long narrow secondary process of the vinculum, whilst the female is distinguished by the extremely anterior position of the pockets in sternite 8. One of the two females examined has deformed genitalia (Fig. 55).

BIOLOGY. Host-plant unknown. The few known adults have been collected at an altitude of about 2600 m. Flight period: July–August.

DISTRIBUTION (Fig. 4). Pyrénées Orientales, Mt Canigou (France).

MATERIAL EXAMINED (including 2 ♂, 2 ♀ genitalia preparations)

Holotype, ♂, **France**: [Pyrénées Orientales,] Mt Canigou, 17.vii.1894 (genitalia slide no. 67, LMP.; MINGA).

Paratypes. **France**: 2 ♂, 2 ♀, Mt Canigou, [1 ♂, 1 ♀] 2609 m, 15.vii–9.viii.1894 (MINGA; MNHN; TM).

Sattleria breviramus sp. n.

(Figs 4, 8, 47)

♂, 9.1 mm. Fore wing (Fig. 8) without distinct dark stripe along fold.

GENITALIA ♂ (Fig. 47). Sternite 8 unknown (abdomen not preserved in preparation). Sacculus basally broad, rounded, with narrow, abruptly tapered distal third. Primary process of vinculum short, not reaching base of sacculus; secondary process hair-like, situated at midpoint of primary process; processes without serrated edges. Saccus parallel-sided. Aedeagus without median projection; apical arm small and almost straight. Base of aedeagus not noticeably splayed.

GENITALIA. ♀ Unknown.

REMARKS. With the exceptionally short primary and thin hair-like secondary process of the vinculum *S. breviramus* is so striking that it warrants description although only the holotype male is known.

BIOLOGY. Host-plant unknown. Flight period: July.

DISTRIBUTION (Fig. 4). Alps (France: Alpes Maritimes).

MATERIAL EXAMINED (including 1 ♂ genitalia preparation)

Holotype ♂, **France**: Alpes Maritimes, [above St Martin-Vésubie,] 'Tre-Colpas, Madone de Fenestre', vii.1933 (*Praviel*) (genitalia slide no. 82, Gibeaux; MNHN).

Sattleria melaleucella (Constant) sp. rev.

(Figs 2, 4, 9–11, 20, 21, 34–39, 56–58, 66)

Gelechia melaleucella Constant, 1865: 197, pl. 7, figs 14 a, b. Syntypes, ♂, ♀, SWITZERLAND: Valais, Riffelberg or Riffelalp, vii [not traced]. [Synonymized with *Gelechia dzieduszzyckii* Nowicki by Rebel, 1889: 315.]

Gelechia mariae Frey, 1867: 302. [Unavailable, nomen nudum.]

Gelechia dzieduszzyckii Now. ssp. *fusca* Burmann, 1954: 345, pl. 18, figs 1–6, text-fig. 1. LECTO-TYPE ♂, AUSTRIA (BURM), here designated [examined]. **Syn. n.**

[*Sattleria dzieduszzyckii* (Nowicki); Povolný, 1965: figs 13, 16; 1967: fig. 32. Misidentifications.]

[*Gelechia dzieduszzyckii* ssp. ?; Povolný, 1987: figs 5–8. Misidentification.]

[*Sattleria dzieduszzyckii* ssp. ?; Povolný, 1987: figs 16 (partim), 20, 23 (labelled in error as 24 in legend), colour pl., figs 6, 9–11. Misidentification.]

♂, 7.3–11.6 mm. ♀, 5.8–8.5 mm. Labial palpus usually with dark apex. Fore wing (Figs 9–11, 20, 21) without dark stripe along fold; with or without irregular dark transverse bands.

GENITALIA ♂ (Figs 34–39). Sternite 8 with slight to deep emargination posteriorly. Sacculus slender, not broadened basally. Primary process of vinculum extending beyond base of sacculus and usually approaching apex of sacculus. Secondary process of vinculum a spine, usually narrow, occasionally triangular (south-eastern form C); arising at basal quarter to basal third of primary process; processes usually without serrated edges. Lateral margins of saccus concave, tapered or parallel. Aedeagus with large or (south-eastern form C) small median projection; apical arm small, straight or slightly curved. Base of aedeagus slightly to distinctly splayed.

GENITALIA ♀ (Figs 56–58). Pair of pockets, at least slightly conical, usually broad, in middle of sternite 8. Pair of distinct longitudinal ridges between pockets well separated, frequently with transverse ridges or fissures in between. Pair of sclerotized areas at base of apophyses anteriores projecting slightly or sloping gradually beyond pockets of sternite 8. Inner edge of apophysis anterior forming even curve with sternite 8. Antrum usually longer than anterior

apophyses; sclerotization at posterior end irregularly convex or produced in an inverted V-shape.

REMARKS. *S. melaleucella* resembles *S. arcuata* from the Pyrenees in its large size, variegated fore wings and the structure of the genitalia. The male differs from that of *arcuata* primarily in the aedeagus, which has a short, straight, rather than long, curved, apical arm and bears a distinct, median projection instead of the conspicuous arch characteristic of *arcuata*. A difference is also found in sternite 8, which is usually emarginated posteriorly rather than rounded as in *arcuata*. In the female genitalia the antrum tube of *melaleucella* almost makes contact with the extended bases of the apophyses anteriores whereas in *arcuata* the sclerotized antrum is separated from the sclerotized parts of sternite 8 by a wide membranous zone. The pockets of sternite 8 are usually broader in *melaleucella* and have a slightly more posterior position than those of *arcuata*; they are not sharply exceeded by the sclerotized areas at the base of the apophyses anteriores.

In Valais the distribution of *melaleucella* overlaps with that of *basistrigella*, but both species are easily distinguished externally by the dark stripe that accompanies the fold in the fore wing of *basistrigella*. The male genitalia of *melaleucella* differ from those of *basistrigella* by the narrow, evenly tapered sacculus and the narrow or triangular rather than broadly rounded or subrectangular secondary process of the vinculum. In the female genitalia of *melaleucella* the two longitudinal ridges between the pockets of sternite 8 are widely separated, whilst they more or less merge in *basistrigella*.

In the male there is considerable variation in the shape of sternite 8; the median emargination is shallow to deep and the two halves separated by it are posteriorly rounded to angular. The secondary process of the vinculum is subject to individual variation in length and width, and in one specimen from the Alpes-Maritimes (Fig. 37) it approaches that of *angustispina*. In this specimen the apical arm of the aedeagus is longer than usual, though not as long as in *arcuata*. In one female of *melaleucella* the antrum barely exceeds the apophyses anteriores; in two of the 12 females examined the genitalia are deformed. *G. melaleucella* was described from an unspecified number of specimens of both sexes, none of which have been traced. The lectotype designation by Viette (1951: 340) is invalid because the specimen he selected does not agree with Constant's original description or colour illustrations and thus could not have been part of the syntype series. Viette's 'lectotype' male, subsequently referred to as 'holotype

male' ('das holotypische Männchen') by Povolný (1983: 182) is in fact *basistrigella*.

G. dzieduszyckii fusca was described from a long series of specimens of both sexes, published as 'Typus ♂', 'Typus ♀' and 'Paratypen'. As no holotype was specified we formally designate as lectotype the specimen referred to as 'Typus ♂' and labelled as holotype by Burmann.

The name *Gelechia mariae* fails to conform to the *Int.-Code-zool.-Nom.*, Article 12, and thus is nomenclaturally unavailable. It was first proposed without a description, definition or indication (Frey, 1867: 302). The single specimen from Engadin, 'St. Maria', originally mentioned is still in the Frey collection (BMNH) and is a male of *S. melaleucella*.

GEOGRAPHICAL VARIATION. Specimens from the north-east of the range (Austria, eastern Switzerland), here termed form A (Figs 10, 21), usually have a more uniformly dark fore wing pattern than those from south-westerly localities (western Switzerland, Italy except Adamello mountains and Monte Baldo), here termed form B (Figs 9, 20), and also differ slightly in genital structure. Form A is usually larger, with a fore wing length of 9.8–11.6 mm (males), 7.3–8.5 mm (females), compared with 7.3–10.6 mm (males), 5.8–7.0 mm (females) in form B.

In the male of form A (Fig. 34) the secondary process of the vinculum is directed laterally, rather than posteriorly as in most specimens of form B, and tends to be broader (Figs 35–37). In the female of form A (Figs 57, 58) the posterior end of the sclerotized antrum is always a long inverted V, whereas in form B (Fig. 56) it varies from a short inverted V to irregularly rounded. The inverted V of form A ranges from 0.75–1.50 times the length of the tubular part of the antrum whilst in form B it is at most a little over half that length. The distance between the pockets of sternite 8 in the female is also variable and in form A is usually at least one-third the width of the entire segment (rarely less) whilst in the small sample of form B it never exceeds one-quarter that width.

Several of the specimens examined do not correspond exactly to either form. A female from Austria has the variegated fore wings of form B. A male from an intermediate locality, Engadin (Switzerland), has the fore wing pattern of form B but a secondary process of the vinculum resembling that of form A. Two males and one female from Savoie, the western end of the range of form B, also exhibit some intermediate characters. Their uniform but pale fore wing colour does not match that of either form whilst the secondary

process of the vinculum resembles that of form A; the associated female agrees with form A in the wing pattern and the distance between the pockets of sternite 8, but with form B in the sclerotization of the antrum. A male from the Alpes-Maritimes agrees with form B in genital characters but is intermediate in the wing pattern. In the males from the Appennino Abruzzese the apex of the secondary process of the vinculum tends to be blunter than in other *melaleucella*.

Whilst forms A and B only differ slightly from each other, specimens from the Adamello mountains and Monte Baldo, here termed form C, are more distinct. Form C falls within the size range of form B, which it also resembles in wing pattern, although it tends to have less distinct dark patches and sometimes is pale (Fig. 11). In some specimens of form C the traces of an irregular dark stripe are visible along the fold of the fore wing. In the male genitalia (Figs 38, 39) the secondary process of the vinculum is shorter and the primary process tends to be broader than in the other forms. In its direction the secondary process resembles that of form B but it tends to arise further from the base of the primary process than in either form A or B. The median projection of the aedeagus is much shorter than in other *melaleucella*. No females of form C were available for study. The differences between the three forms are insufficient to warrant giving them formal taxonomic status.

BIOLOGY. Host plants: *Cerastium latifolium* L., *C. uniflorum* Clairv., probably also *Moehringia* sp. (Caryophyllaceae); *Saxifraga biflora* subsp. *macropetala* (Kern.) Rouay & Camus (Saxifragaceae).

Larva fully grown about 14–15 mm long; head brown with darker speckles; prothoracic plate yellowish brown, thoracic legs blackish brown, lighter on inner side; abdomen light yellowish brown to loamy yellow with brown to reddish brown longitudinal lines, pinacula large, brown, setae short, light, anal plate and abdominal prolegs yellowish brown.

The lively larva inhabits a silken tube that is spun along parts of the host-plant, often extending from the tip of a shoot to the root or nearby stones towards which the larva quickly retreats when disturbed. Pupation takes place in a small cocoon that is frequently spun under a stone or sometimes under parts of the host-plant. In July/August young and mature larvae, pupae and adults can be found at the same time. (Burmman, 1954: 350; 1977: 146.) Flight period: July–mid-September.

S. melaleucella usually occurs on sparsely vegetated scree between 2000 and 3500 m; observations as low as 1600 m are exceptional. In the

Lechtaler Alpen it is found in the summit regions where *Saxifraga biflora* subsp. *macropetala* is the dominant plant and also the main host-plant of the larva, although some larvae were found on *Cerastium uniflorum* and a single pupa amongst *Moehringia* (Burmman, 1954: 348; 1977: 143; Huemer & Sattler, pers. obs.). In the Brandner Valley, where it occurs above 2500 m on coarse scree with an *Androsace helvetica* – *Geum reptans* plant association, the host-plant of the larva is *Cerastium latifolium*; *Geum reptans* L. (Rosaceae), offered in captivity, was rejected (Huemer, pers. comm.).

DISTRIBUTION (Fig. 4). Alps (France: Alpes Maritimes to Austria: Lechtaler Alpen); Appennino Abruzzese. According to the literature also in the Allgäuer Alpen (Povolný, 1987: fig. 8, as *Gelechia dzieduszyckii* ssp. ?).

MATERIAL EXAMINED

Forms A and B (including 23 ♂, 12 ♀ genitalia preparations)

Lectotype ♂ (*fusca*), **Austria**: N. Tirol, [Lechtaler Alpen,] Muttekopf, 2700 m, 30.vii.1951 (Burmman) (BURM).

France: 1 ♂, [Alpes Maritimes,] Mt Mounier, 13.viii (MNHN); 2 ♂, [Savoie,] Col du Galibier, [1 ♂] 2500 m, viii.1974, 8.viii.1979 (BURM; MNHN); 1 ♀, Savoie, Col de l'Iseran, 2800–3000 m, 21.viii.1937 (MNHN). **Italy**: 1 ♂, [N. Italy,] 'Bozen'; 2 ♂, 'Monte Rosa', Mt Camoscio, 3, 4.viii.1906 (NM); 2 ♂, Abruzzo, Gran Sasso, 25.vii.1935 (MCSN); 2 ♂, Abruzzo, M Portella, 4.vii, 2.viii.1924 (MCSN); 1 ♂, Abruzzo, Mt Velino, 18.vii.1933 (MCSN). **Switzerland**: 1 ♂, [no data] (MNHN); 3 ♂, Valais (BMNH, MINGA); 1 ♂, V., near Montana, Mt Bonvin, 2900 m, 18.vii.1958 (WHIT); 1 ♂, [V., Turtmann Tal,] Gruben, vii.1904 (NMB); 2 ♂, [V.,] Trifhorn, [1 ♂] 3500 m, 7.viii.1920 (NMB); 1 ♂, [V.,] Mettelhorn, 30.vii.1934 (ETH); 4 ♂, [V.,] Zermatt; 1 ♂, 1 ♀, [V.,] Riffelberg, 26.vii.1928 (ETH); 3 ♂, 3 ♀, [V.,] Gornergrat, [1 ♂] 3000 m, 2.viii–13.ix.1934, 1937, 1969 (ETH; BURM; NMB; WHIT); 1 ♂, [V., Gamser Tal,] Gamsen ('Gamson') (MNHN); 1 ♂, [V.,] Simplon, 16.vii.1912 (NM); 2 ♂, Simplon ('Sempione') (ETH); 7 ♂, 1 ♀, [Ticino,] 'Campolungo Pass', [1 ♂] 2324 m, 18–28.vii.1922, 1942, 1950 (NMB; ETH; BURM); 1 ♂, [Ticino,] Pizzo Molare, 11.viii.1918 (NMB); 2 ♂, [Glarner Alpen,] Sardona ('Sardonna'), 19.vii.1901, 19.viii.1910 (NMB); 1 ♂, Engadin, Sta Maria. **Austria**: 2 ♂, 1 ♀, Vorarlberg, Brandner Tal, 'Wildberg', 2750 m, 22.viii.1984 (HUEM); 1 ♂, Brandner Tal, 'Tote Alpe', 2550, 14.viii.1985 (HUEM); 1 ♂, Brandner Tal, 'Sonnenlagant Alpe', 1600 m, 9.vii.1983

(HUEM); 18 ♂, 11 ♀ (*fusca* paralectotypes), N. Tirol, [Lechtaler Alpen,] Muttekopf, 2700 m, 30.vii.1951, 26.vii., 5.viii.1953 (*Burmman*) (BURM); 2 ♂, Muttekopf, 2650, 2700 m, 12.viii.1987, 14.viii.1965 (BMNH; BURM); 1 ♀, Muttekopf, 2500 m, pupa on *Moehringia*, 12.viii.1987, moth emerged 18.viii.1987. No locality data: 7 ♂, 1 ♀ (BMNH; MINGA).

Form C (including 5 ♂ genitalia preparations)

Italy: 11 ♂, Adamello Mts, Mte Mandrone ('Mandron'), 2500, 2700, 2800 m, 30.vii-mid viii.1958, 1964; 1 ♂, Mte Baldo, 'Telegrafo', 2150 m, mid vii.1969; (all BURM).

***Sattleria basistrigella* (Müller-Rutz) stat. n.**

(Figs 4, 12–14, 22, 23, 40–43, 59, 60, 67)

Gelechia dzieduszykii [sic] f. *basistrigella* Müller-Rutz, 1934: 121, pl. 1, fig. 7.

♂, 8.2–10.0 mm. ♀, 5.5–7.0 mm. Labial palpus usually without dark apex. Fore wing (Figs 12–14, 22, 23) with dark stripe from base to one-third or two-fifths, along fold; males with diffuse irregular dark transverse band at two-thirds, sometimes faint, usually more pronounced at costa; some females with dark apex.

GENITALIA ♂ (Figs 40–43). Sternite 8 rounded posteriorly. Sacculus broad basally, widest at about middle to distal third, apex more or less abruptly tapered. Primary process of vinculum distally about level with apex of sacculus; secondary process very broad-based, large, subrectangular or more or less evenly rounded, edge sometimes uneven or weakly serrated. Saccus usually tapered. Aedeagus usually without, rarely with (south-western form), distinct median projection; apical arm short, straight or slightly curved. Base of aedeagus at most slightly played.

GENITALIA ♀ (Figs 59, 60). Pair of narrow pockets in anterior or (south-western form) posterior half of sternite 8, with posterior edge of pocket up to two-thirds from anterior margin of sternite. Pockets at least slightly distant from anterior margin of sternite. Pair of distinct, irregular longitudinal ridges between pockets close together. Pair of sclerotized areas, at base of apophyses anteriores, projecting slightly or sloping gradually beyond pockets of sternite 8. Inner edge of apophysis anterior forming even curve with sternite 8. Antrum usually barely longer than apophyses anteriores; sclerotization at posterior end irregular.

REMARKS. *S. basistrigella* is distinguished externally from all *Sattleria* species except *styriaca* by the

distinct continuous black stripe along the basal two-thirds of the fore wing fold. This stripe is an extension of the plical stigma which, in other species, is streak-like but not extended to the wing base. The male genitalia of *basistrigella* are distinguished from those of other species either by the medially broad rather than evenly tapered sacculus or the broad secondary process of the vinculum. Differences from *melaleucella*, with which *basistrigella* occurs together in some localities, and *styriaca* are discussed under those species.

GEOGRAPHIC VARIATION. Specimens from the south-western and eastern extremes of the range tend to be slightly smaller than those of the main form. In the male genitalia they resemble each other in the basal swelling of the sacculus, which is smoothly rounded whereas in the main form it is spinose and often irregularly rounded, and the secondary process of the vinculum, which is larger and more rounded than that of the main form. The south-western form (Savoie) differs from other *basistrigella* in the presence of a median projection on the aedeagus. In the female of the south-western form the pockets of sternite 8 are broader and inserted more posteriorly than in the main form; the female of the eastern form (*basistrigella triglavica*) is still unknown.

The name *triglavica* Povolný, originally proposed as a subspecies of *dzieduszyckii*, is here retained for the eastern form of *basistrigella*, although there are only slight differences between this and the south-western form.

BIOLOGY. Host-plant: *Silene acaulis* (L.) Jacqu. (Caryophyllaceae). The larva (Fig. 67), which is similar to that of *melaleucella*, was observed in July, living in a silken tube on the host-plant (Whitebread, pers. comm.). Flight period: July–August. Adults reared by Whitebread from larvae collected on 23.vii.1984 emerged 29.ix–9.x.1984, at a time when their natural habitat may already have been snow-covered. *S. basistrigella* occurs from about 2400 m to above 3000 m.

DISTRIBUTION (Fig. 4). Alps (France: Savoie, to Yugoslavia: Julijske Alpe).

***Sattleria basistrigella basistrigella* (Müller-Rutz)**

(Figs 4, 12, 13, 22, 23, 40, 41, 59, 60, 67)

Gelechia dzieduszykii [sic] f. *basistrigella* Müller-Rutz, 1934: 121, pl. 1, fig. 7. **LECTOTYPE** ♂, SWITZERLAND (ETH), here designated [examined].

[*Gelechia melaleucella* Constant; Viette, 1951: 340. Misidentification.]

'*Gelechia*' *dzieduszyckii* Now. v. *basistrigalis* M.R.; Klimesch, 1963: 13. [Incorrect subsequent spelling of *basistrigella* Müller-Rutz.] [*Gelechia dzieduszyckii* sp. ?; Povolný, 1987: fig. 10. Misidentification.]

[*Sattleria dzieduszyckii* ssp. ?; Povolný, 1987: fig. 16 (partim), colour pl., fig. 7. Misidentification.]

♂, ♀, (Figs 12, 13, 59, 60). As described on p. 221.

GENITALIA ♂ (Figs 40, 41). As described on p. 221.

GENITALIA ♀ (Figs 59, 60). As described on p. 221.

REMARKS. *S. b. basistrigella* was described from an unspecified number of males and females from Gornergrat and nearby Trift. We have examined five males of the type series from the collections of the ETH and NMB. Six further specimens in the ETH bearing 'Type' or 'Cotype' labels cannot be regarded as type material since they bear dates of collection subsequent to the original description or are from a different locality.

DISTRIBUTION (Fig. 4). Alps (France: Savoie, Switzerland, Italy).

MATERIAL EXAMINED

Main form (including 9 ♂, 4 ♀ genitalia preparations)

Lectotype ♂, **Switzerland**: [Valais,] Gornergrat, 19.vii.1931 (*Weber*) (genitalia slide no. 1259; ETH).

Switzerland: 4 ♂, 2 ♀, Valais (BMNH; MNHN); 1 ♂, V., Grand St Bernard, 2472 m, 5.viii.1980 (WHIT); 2 ♂, 2 ♀, V., [Zermatt,] Schwarzsee, [2 ♂, 2 ♀] 2580 m, 9.viii.1932, [e.l.] 29.ix.1984, [e.l.] 6, 9.x.1984 (WHIT; ETH); 5 ♂, 3 ♀, V., Zermatt, Trift, [4 ♂] 2700, 2800 m, 18.vii-2.viii.1934, 1981, 1982 (WHIT; ETH; NMB; BURM); 3 ♂ (paralectotypes), Trift, 23.vii.1928, 7.viii.1932 (*Weber & Müller-Rutz*) (ETH; NMB); 2 ♂, 2 ♀, Zermatt, 27.vii.1934 (ETH); 1 ♂, [near Zermatt,] Täsch, 2850 m, 2.viii.1984 (WHIT); 1 ♂ (paralectotype) [V.,] Gornergrat, 31.vii.1932 (*Müller-Rutz*) (NMB); 6 ♂, 2 ♀, Gornergrat, 19-30.vii.1925, 1934 (NMB; ETH; MNHN); 1 ♂, V., Binn, 2-7.viii.1908; 1 ♀, V., 'Col du Pigne', 3130 m, 23.vii.1983 (WHIT). **Italy**: 1 ♂, [N. Italy,] 'Bozen'; 1 ♂, Carbonin ('Schluderbach') (NM). No locality data: 5 ♂, 14, 27.vii.1905 (BMNH; MNHN; TM).

South-western form (including 3 ♂, 2 ♀ genitalia preparations)

France: 8 ♂, Savoie, Bonneval-sur-Arc, 24.vii, 14.viii.1912 (MNHN); 2 ♀, [S.], Col d'Iseran, [1 ♀] 2900 m, 21.viii.1937, 24.viii.1974 (MNHN); 1 ♂, S., Val-d'Isère, 30.vii.1895 (MNHN).

Sattleria basistrigella triglavica (Povolný) stat. n.

(Figs 4, 14, 42, 43)

Sattleria dzieduszyckii triglavica Povolný, 1987: 91, colour pl., figs 4, 5. Holotype ♂, YUGOSLAVIA: 'Krain', Triglav, 2400 m, mid vii.1927 (Povolný collection, Brno) [not examined].

Gelechia dzieduszyckii triglavica Povolný, 1987: figs 3, 4.

♂. Dark stripe on fore wing (Fig. 14) and diffuse irregular transverse band fainter than in other *basistrigella*.

GENITALIA ♂ (Figs 42, 43). Saccus less swollen than in other *basistrigella*. Secondary process of vinculum a broad-based rounded lobe situated at base of primary process. Saccus parallel-sided. Aedeagus with, at most, indistinct median projection.

GENITALIA ♀ Unknown.

REMARKS. Povolný believed all *Sattleria* specimens to represent just one variable species and consequently described *triglavica* as a subspecies of *dzieduszyckii*. Our study has shown that it is conspecific with *basistrigella* rather than *dzieduszyckii* sensu stricto and is particularly similar to the south-western form (Savoie) of that species. We have been unable to examine the holotype of *triglavica* but have studied other specimens from the type-locality Triglav. The paratypes from Steiermark are not conspecific with *basistrigella* and represent *S. styriaca* sp. n.

The following type material of *triglavica* was recorded in the original description:

Holotype ♂, 1 paratype ♂, Krain, Triglav, 2400 m, mid-vii.1927 (*unspecified collector*). One of the two moths was illustrated by Povolný (1987: colour pl., fig. 4) together with the genitalia of the paratype (text-fig. 3). [Not examined.]

Paratype ♂, Montenegro, Durmitor, 2000 m, 2.viii. (Penther). The moth and genitalia were illustrated by Povolný (1987: colour pl., fig. 5; text-fig. 4). [Not examined.]

Paratype ♂, Albania, Korab, 28-31.vii.1918 (*Albania-Expedition, Mus. Vienna*). [Not examined.]

Paratype ♂, Steiermark, Dachsteingebiet, 2300 m, 24.vii.1923 (*collector unknown*) (genitalia slide no. 1836, NM). [Examined.] Neither the moth nor the associated genitalia preparation are labelled as 'paratype'; however, the latter is identified as 'ssp. *triglavica*' on Povolný's slide label. Our examination has shown that this specimen is not conspecific with *triglavica* but represents *S. styriaca* sp. n.

[? Paratype] ♀, Steiermark, Seetaler Alpen,

Zirbitzkogel, 2200 m, Z. ['Zucht', indicates reared specimen] 28.vii.1911 (*collector unknown*) (genitalia slide no. 1837, NM). [Examined.] This specimen was omitted from Povolný's list of material examined on p. 92, but was recorded on p. 97 (legend to text-fig. 19). Although the altitude is there given as 2300 m and the date of capture as 22.vii., the genitalia are clearly those illustrated in text-fig. 19 and in earlier papers (Povolný, 1965: fig. 15; 1967: fig. 31); they represent *S. styriaca* sp. n.

The depository of the type material was not specified in the original description; however, according to Lödl (in lit., 8.iv.1987), Povolný claims the first four specimens to be his property, although there is evidence in the literature (Rebel, 1913: 330; Rebel & Zerny, 1931: 146) that at least those from Montenegro and Albania originated from the NM, Vienna.

BIOLOGY. Host-plant unknown. Flight period: July–August.

DISTRIBUTION (Fig. 4). Julijske Alpe (north-western Yugoslavia). Also recorded from south-western Yugoslavia (Montenegro, Durmitor) (Povolný, 1987: 92, text-fig. 4; colour pl., fig. 5) and Albania (Korab) (Povolný, 1987: 92); however, we were unable to examine specimens from those localities and thus cannot confirm these records.

MATERIAL EXAMINED (including 2 ♂ genitalia preparations)

Yugoslavia: 2 ♂, Slovenija ('Carniola'), Triglav, 26.vii, 3.viii.1929 (Kautz) (NM).

Sattleria styriaca sp. n.

(Figs 4, 15, 24, 44, 61)

[*Sattleria dzieduszyckii* (Nowicki); Povolný, 1965: fig. 15; 1967: fig. 31. Misidentifications.]

[*Sattleria dzieduszyckii* ssp. ?; Povolný, 1987: fig. 11. Misidentification.]

[*Sattleria dzieduszyckii triglavica* Povolný; Povolný, 1987: fig. 19. Misidentification.]

♂, 10.0–10.8 mm. ♀, 7.6 mm. Labial palpus with dark apex. Fore wing (Figs 15, 24) with dark stripe from base to one-third or two-fifths, along fold; usually with diffuse irregular dark transverse band at two-thirds (males), sometimes faint, or (females) near apex.

GENITALIA ♂ (Fig. 44). Sternite 8 rounded posteriorly. Saccus composed of broad, blunt-ended basal section and narrow, curved, gently tapered distal part. Primary process of vinculum short, apex about level with blunt end of saccus;

secondary process broad-based, posteriorly tapered lobe arising at base of primary process; processes smooth, without serrated edges. Saccus distinctly tapered. Aedeagus with tiny median projection; apical arm small and more or less straight. Base of aedeagus scarcely splayed.

GENITALIA ♀ (Fig. 61). Pair of broad, rounded pockets near but not directly at anterior margin of sternite 8. Pair of longitudinal ridges between pockets of sternite 8 indistinct. Pair of sclerotized areas, at base of apophyses anteriores, projecting slightly or sloping gradually beyond pockets of sternite 8. Inner edge of apophysis anterior forming even curve with sternite 8. Antrum about as long as apophyses anteriores; sclerotization at posterior end irregular, barely convex.

REMARKS. Externally *S. styriaca* resembles *basisstrigella* in the presence of a black continuous plical stripe on the fore wing. It differs in the male genitalia by the characteristic saccus with a long, strongly curved apical portion and by the broadly based, posteriorly tapered secondary process of the vinculum. The female genitalia are distinguished from those of some forms of *basisstrigella* by the anterior position of the sternal pockets and the absence of distinctly sclerotized longitudinal folds between them. In the main form of *basisstrigella* the sternal pockets are in a similarly anterior position but are smaller and more pointed.

BIOLOGY. Host-plant unknown. The few adults known to date have been collected at an altitude of about 2200–2300 m. Flight period: late July–beginning of August.

DISTRIBUTION (Fig. 4). Alps (Austria: Steiermark).

MATERIAL EXAMINED (including 3 ♂, 2 ♀ genitalia preparations)

Holotype ♀, **Austria:** Steiermark, Seetaler Alpen, 'Zirbitzkogel', 2200 m, 1.viii.1911 (genitalia slide no. 11240; NM).

Paratypes. **Austria:** 2 ♂, 1 ♀, Steiermark, Seetaler Alpen, 'Zirbitzkogel', 2300 m, 22.vii.1911 (NM); 1 ♂, Steiermark, Dachstein area, 2300 m, 24.vii.1923 (NM). No locality data: 1 ♂ (NM).

Sattleria dzieduszyckii (Nowicki)

(Figs 4, 16, 25, 26, 45, 46, 62)

Gelechia (*Anacamptis* HS) *dzieduszyckii* Nowicki, 1864: 20, fig. 4. Syntypes, ♂, POLAND: Tatry [near Zakopane]: Bobrowiec; Kopa Magury ('Magóra'); Kosista ('Koszysta'); Wołoszyn; viii (Nowicki) [not traced].

Gelechia dzieduszyckii tatrica Gregor & Povolný, 1955: 120, 127, phot. 2, fig. 4. Holotype ♂, CZECHOSLOVAKIA: Vysoké Tatry, Rysy, 2000 m, 23.vii.1951 (Miller) (MM) [not examined]. [Synonymized by Povolný, 1987: 91.]

♂, 6.9–8.8 mm. ♀, 4.9–5.6 mm. Fore wing (Figs 16, 25, 26) usually uniform, without large dark areas, some males with diffuse dark spot at two-thirds, mainly at costa; plical stigma sometimes indistinctly extended towards wing base.

GENITALIA ♂ (Figs 45, 46). Sternite 8 emarginate posteriorly. Sacculus evenly tapered, basal part not conspicuously broadened. Primary processes of vinculum almost level distally with apex of sacculus, ventral edge slightly serrated, except apically; secondary process arising at slight distance from base of primary process, consisting of a moderately broad, rounded lobe resembling a shark's fin, with uneven or slightly serrated edge. Saccus with parallel margins or slightly tapered. Aedeagus with weak median projection; apical arm short, almost straight to moderately curved; base rarely distinctly splayed.

GENITALIA ♀ (Fig. 62). Pair of broad pockets in posterior half of sternite 8; posterior edge of pocket at least two-thirds from anterior end of sternite. Pair of sclerotized areas at base of apophyses anteriores without broad, rounded structure; distance between outer edges of these usually less than or equal to distance between outer edges of pockets, occasionally slightly greater. Inner edge of apophysis anterior forming even curve with sternite 8. Antrum barely shorter than apophyses anteriores; sclerotization at posterior end irregularly convex.

REMARKS. Externally *dzieduszyckii* closely resembles *pyrenaica* in size, coloration and wing pattern, but is easily distinguished by the male and female genitalia; differences are discussed under *pyrenaica*. In the fore wing of *dzieduszyckii* the plical streak is sometimes extended towards the wing base as in *basistrigella*, but it is less pronounced than in the latter. The male genitalia of *dzieduszyckii* are distinguished from those of most other *Sattleria* species by the broadly rounded secondary process of the vinculum; they differ from those of *basistrigella*, which sometimes have a similar though distinctly broader rounded process, by the evenly tapered sacculus. The female genitalia of *dzieduszyckii* are distinguished from those of all *Sattleria* species, except *pyrenaica*, by the posterior position of the broad pockets in sternite 8. The differences from *pyrenaica* are discussed under that species.

In the original description of *dzieduszyckii*,

Nowicki referred to both males and females but later admitted that he had been mistaken and in fact had only seen males (Rebel, 1889: 315). According to Rebel there should be type-specimens in NM, Vienna; however, amongst other *dzieduszyckii* from the Tatra mountains we located in that collection only one male originating from Nowicki. This specimen is dated 1865, too late for it to have syntype status.

G. dzieduszyckii tatrica was described from the holotype and five paratypes, all males, from Vysoké Tatry. When proposing this subspecies, Gregor & Povolný separated it from the populations of the Alps but overlooked the fact that the Tatra mountains are the type-locality of the nominate subspecies *d. dzieduszyckii*.

BIOLOGY. Host-plant not known with certainty. In the north-western Carpathians (Tatry), Povolný (1987: 88) observed larvae in silken tubes on *Saxifraga* species (Saxifragaceae) but failed to rear the adults. In a locality in the southern Carpathians (Bucegi), where we found the adults in late July – early August 1984, *Saxifraga* was so rare that other host-plants such as *Silene acaulis* or *Cerastium* (Caryophyllaceae) were probably involved. The larva has not yet been described but is likely to resemble that of *melaleucella* and have a similar biology. Flight period: late June – mid-August, annually variable.

S. dzieduszyckii occurs on alpine pastures or sparsely vegetated ground and scree between about 1800 and 2600 m. In the Bucegi mountains (southern Carpathians), on a plateau at about 2000 m, we observed the adults in pasture with dense, heavily grazed grass and some alpine vegetation.

DISTRIBUTION (Fig. 4). North-western Carpathians (Polish and Czechoslovakian Tatry), southern Carpathians (Rumanian Carpatii Meridionali). Included by Piskunov (1981: 689) amongst the Gelechiidae of the European U.S.S.R. as occurring in the Carpathians. Although no detailed locality was recorded, the presence of *dzieduszyckii* in the Ukrainian Carpathians with their highest mountains just above 2000 m is not impossible. A record for 'Hungary' (Pável & Uhryk, 1896: 69, as *melaleucella*) which, in its present borders, lacks mountains high enough to have an alpine zone, dates back to the time of the Austro-Hungarian empire and applies to the north-western Carpathians. Also recorded from Bulgaria (Rila Planina) (Rebel, 1903: 329), but we were unable to trace voucher specimens and the status of that population remains uncertain. All previous records of *dzieduszyckii* from the Pyrenees, Alps and Appennino apply to other *Sattleria* species.



6



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Figs 5–10 Wings of *Sattleria* males. 5, *S. arcuata*. 6, *S. pyrenaica*. 7, *S. angustispina*. 8, *S. breviramus*. 9, *S. melaleucella* (form B, Switzerland: Valais). 10, *S. melaleucella* (form A, Austria: Lechtaler Alpen).



Figs 11–16 Wings of *Sattleria* males. 11, *S. melaleucella* (form C). 12, *S. basistrigella basistrigella* (main form). 13, *S. basistrigella basistrigella* (south-western form). 14, *S. basistrigella triglavica*. 15, *S. styriaca*. 16, *S. dzieduszyckii*, Tatry.



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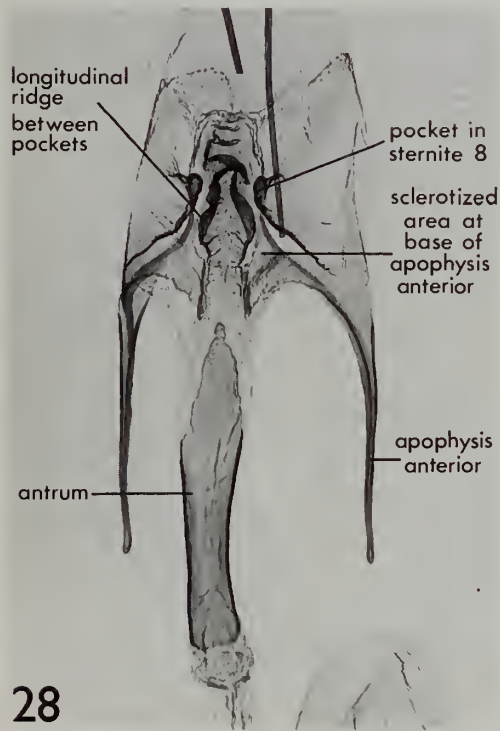
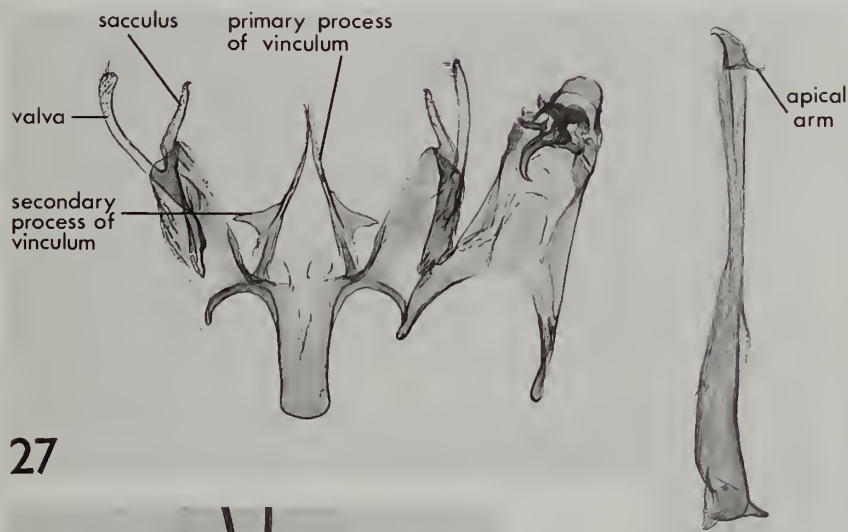


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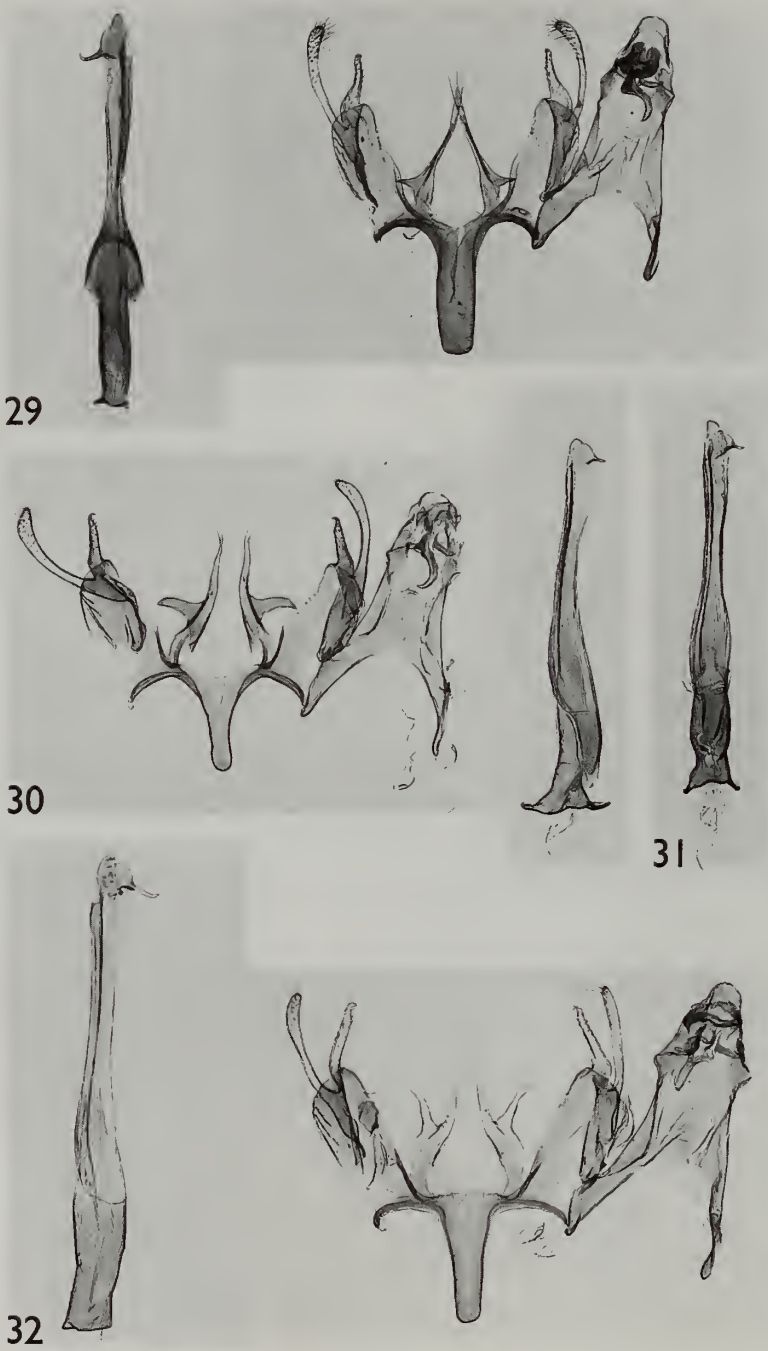
Figs 17–22 *Sattleria* females. 17, *S. arcuata*. 18, *S. pyrenaica*. 19, *S. angustispina*. 20, *S. melaleucella* (form B, Switzerland: Valais). 21, *S. melaleucella* (form A, Austria: Lechtaler Alpen). 22, *S. basistrigella basistrigella* (main form).



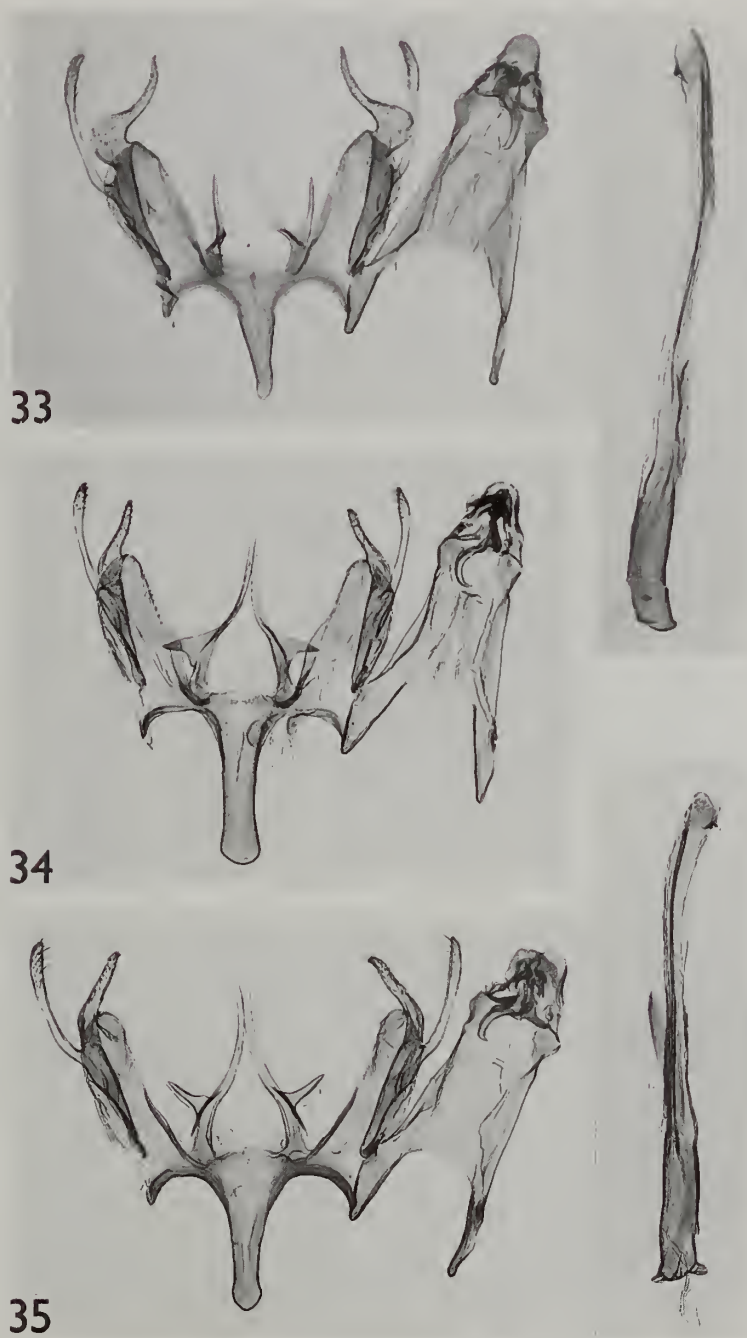
Figs 23–26 *Sattleria* females. 23, *S. basistrigella basistrigella* (south-western form). 24, *S. styriaca*. 25, *S. dzieduszyckii*, Tatry. 26, *S. dzieduszyckii*, southern Carpathians.



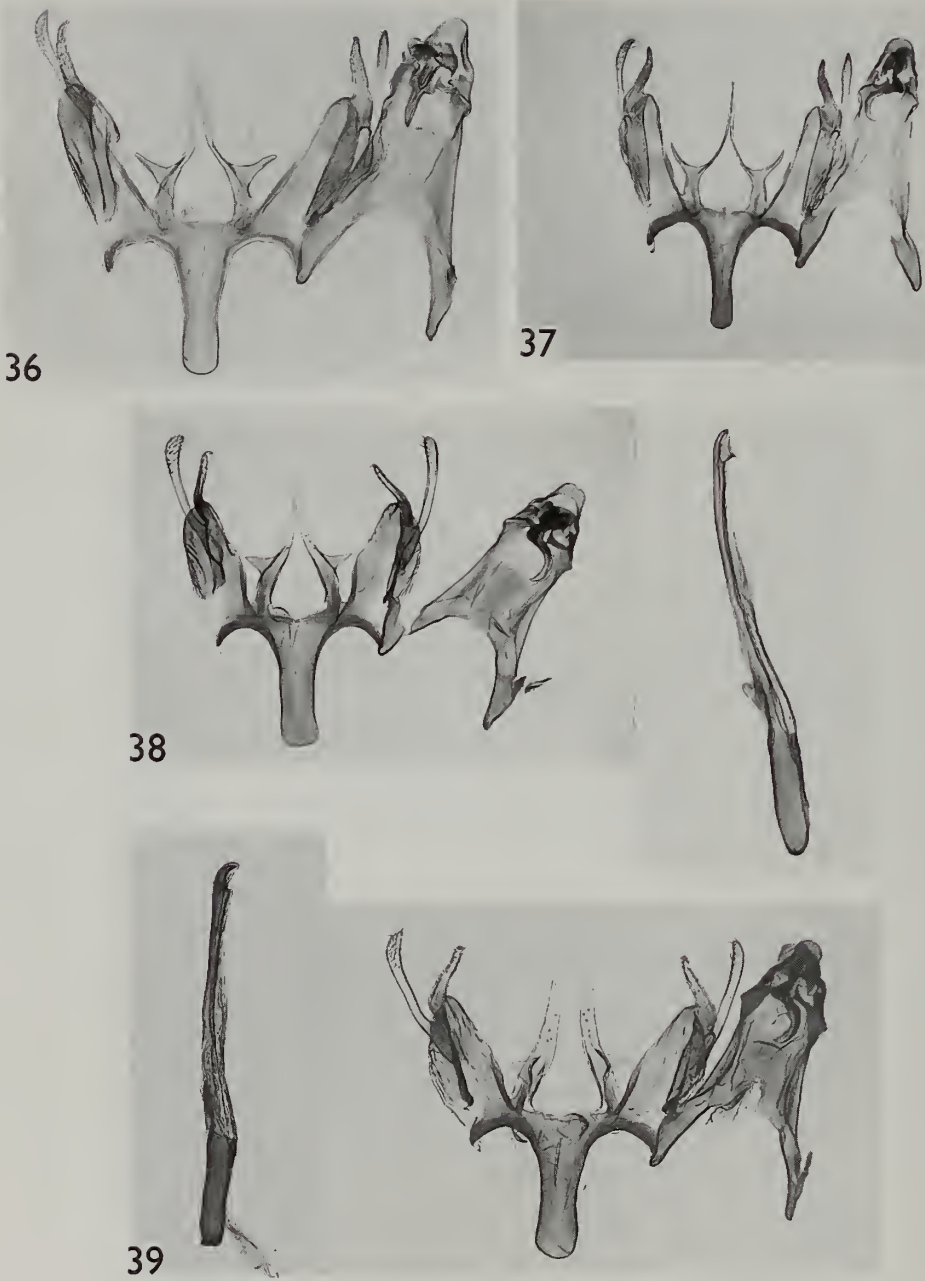
Figs 27, 28 Genitalia of *Sattleria* species. 27, male hybrid between *S. arcuata* and *S. pyrenaica*. 28, female *S. pyrenaica*.



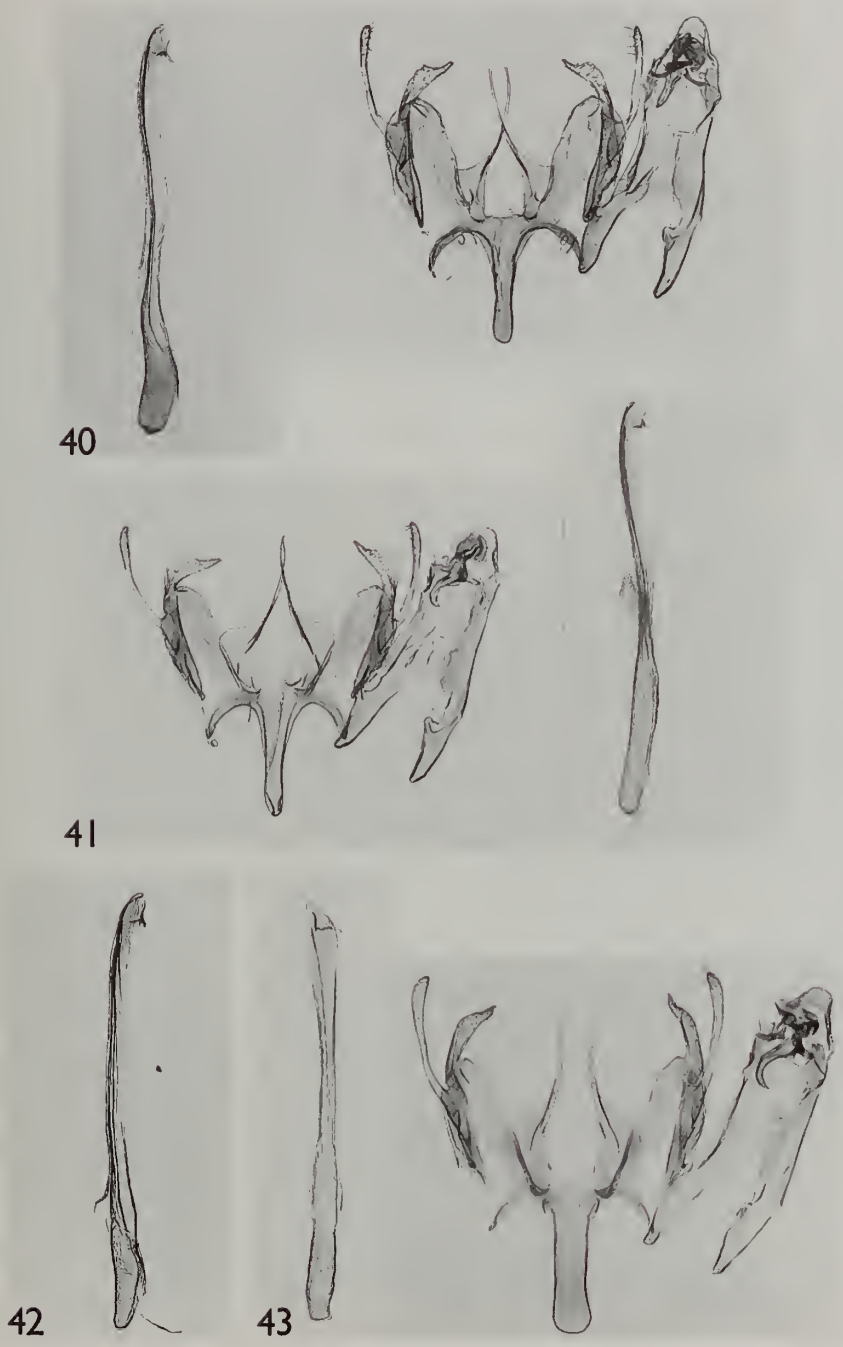
Figs 29–32 Male genitalia of *Sattleria* species. 29, *S. arcuata*. 30, *S. pyrenaica* (main form) and 31, variation in the aedeagus. 32, *S. pyrenaica* (eastern form).



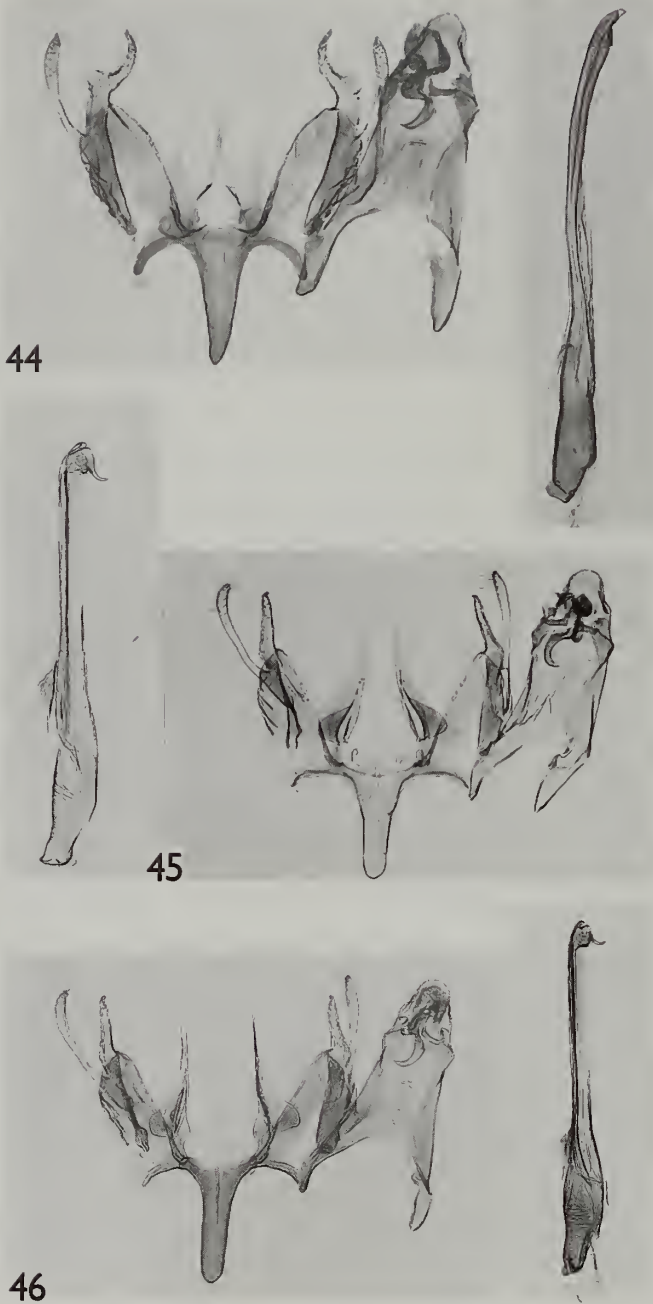
Figs 33–35 Male genitalia of *Sattleria* species. 33, *S. angustispina*. 34, *S. melaleucella* (form A, Switzerland: Glarner Alpen). 35, *S. melaleucella* (form B, N. Italy: 'Bozen').



Figs 36–39 Male genitalia of *Sattleria melaleucella*. 36, form B, Italy: Appennino Abruzzese. 37, form B, France: Alpes Maritimes. 38, form C, Italy: Adamello. 39, form C, Italy: Adamello.



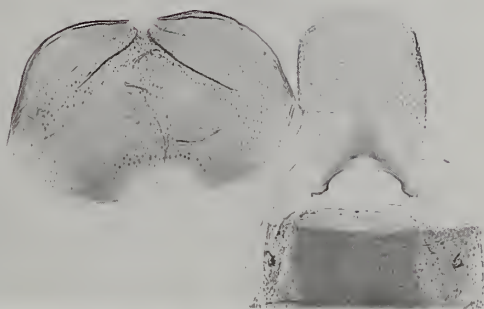
Figs 40–43 Male genitalia of *Sattleria* species. 40, *S. basistrigella basistrigella* (main form). 41, *S. b. basistrigella* (south-western form). 42, *S. b. triglavica* (aedeagus). 43, *S. b. triglavica*.



Figs 44–46 Male genitalia of *Sattleria* species. 44, *S. styriaca*. 45, *S. dzieduszyckii*, Tatry. 46, *S. dzieduszyckii*, southern Carpathians.



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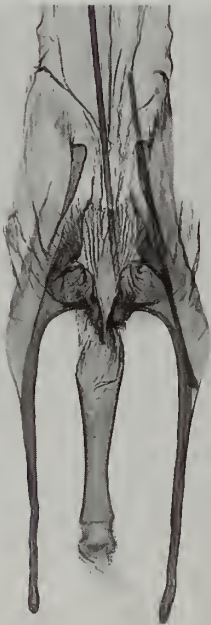
Figs 47–50 Male genitalia of *Satleria* species. 47, *S. breviramus*. 48–50, eighth abdominal segments. (48) *S. arcuata*. (49) *S. pyrenaica*. (50) *S. angustispina*.



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Figs 51–54 Female genitalia of *Sattleria* species. 51, *S. arcuata*. 52, *S. pyrenaica* (central Pyrenees). 53, *S. pyrenaica* (eastern Pyrenees). 54, *S. angustispina* (normal).



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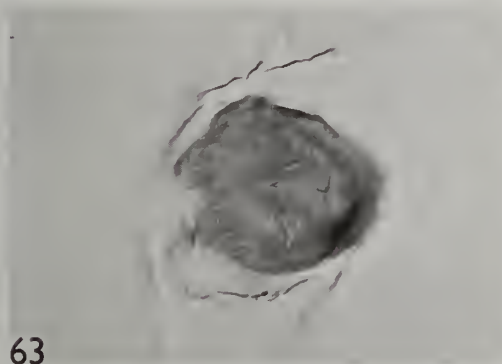


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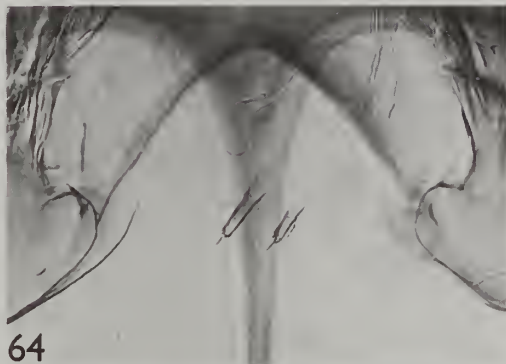
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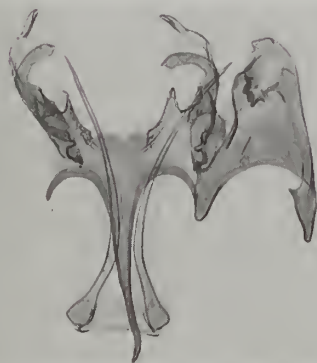
Figs 59–62 Female genitalia of *Sattleria* species. 59, *S. basistrigella basistrigella* (main form). 60, *S. basistrigella basistrigella* (south-western form). 61, *S. styriaca*. 62, *S. dzieduszyckii*.



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Figs 63–67 63, trace of signum in *Sattleria pyrenaica*. 64–66, male genitalia showing structures of the anellus region. (64) *Caryocolum marmoreum*. (65) *Agonochaetia terrestrella*. (66) *Sattleria melaleucella*. 67, larva of *Sattleria basistrigella*.

MATERIAL EXAMINED (including 10 ♂, 3 ♀ genitalia preparations)

Czechoslovakia/Poland: 1 ♂, 1868 (NM); 3 ♂, 1 ♀, Tatry, 1865, 1868, 1871 (NM); 1 ♂, 1 ♀, Tatry, 'Liljowe', 1950 m, 5.vii.1951 (BURM); 1 ♂, Tatry, 'Zawrat', 2000 m, vii.1950. **Rumania:** 15 ♂, 1 ♀, S. Carpathians, Bucegi Mts, Babele, 2200 m, 30.vii-2.viii.1984; 1 ♀, Bucegi Mts ('Bucsecs'), 4.viii.1907 (NM); 1 ♂, [Bucegi Mts.] Omul, 2400, 25.vii (MINGA); 1 ♂, [Bucegi Mts.] Mt Caraiman, 2200 m, 29.vi.1946 (MINGA); 3 ♂, [S. Carpathians, Fagarasului Mts.] Transylvania, Zurul ('Szurul'), 19.vii.1865 (ZI).

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